Graw-Hill Company, Inc.

April 7, 1923

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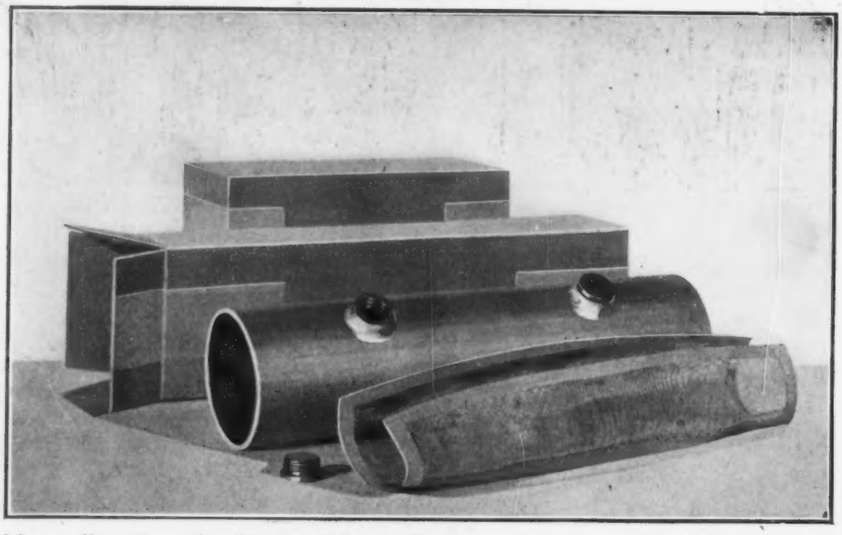
APR

Electrical World

Good Lighting Needed in Parks

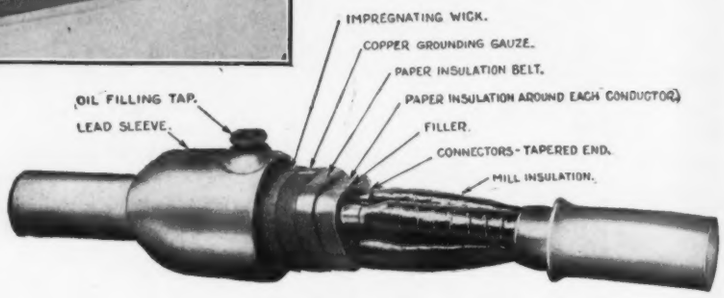
A general recognition of the need for attractive lighting in park districts has led to the development of fixtures and practices suitable to the environment. Congestion in the large cities combined with adequate lighting has increased the night use of parks.

The accompanying views are of the lighting and installation methods used in Tower Grove Park, St. Louis.



Metropolitan Protective Devices (Murray Patents)

This standard package cable joint saves material. There is nothing to waste. It saves time. No trips need be made for materials forgotten. It saves money, being portable and easily installed.



Detailed View Metropolitan Oil-Filled Cable Joint

A New Standard Package Oil Filled Cable Joint That Requires No Vacuum Filler

Contents of Standard Package

Lead Sleeve
Sleeve Stocking
Compound
Paper Insulation
Impregnated Wicking
Rove Filler
Connectors
Emery Cloth
Waste Ends
Gummed Paper
Muslin
Bar 50-50 Solder

When the "OIL FILLED CABLE JOINT" was originally developed, the specifications for cables did not include bending tests, with the consequence that cables then produced were more susceptible to damage by bending than the modern cables built in accordance with the National Electric Light Association specifications, which call for two complete bending cycles, 180° and reverse, on a drum diameter 12 times that of the cable. The application of the vacuum with the "oil filled" cable joints caused the oil to travel a considerable distance into the cable at both sides of the joint, thereby healing any damage sustained at the cable ends by the bending and handling of these ends while splicing and racking the cable, or even in winding on the inner portion of the reel.

With modern, improved cables, we can now omit the vacuum process by using an improved grade of filling oil which gives practically as perfect penetration of the oil from the joint into the cable as formerly with the old type of oil, with vacuum. Our new oil, without vacuum, insures perfect uniformity of saturation between joint and cable ends, superior to any other type of joint filling compound. Therefore, with the improved oil we have removed the necessity of applying the vacuum thereby greatly simplifying the use of the "OIL FILLED CABLE JOINTS" but still retaining all of the numerous advantages and many points of superiority of this type of joint.

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

Volume 81 New York, Saturday, April 7, 1923 *Number* 14

Keep the Public Thinking Constructively

PEOPLE think and people talk. Opinions are formed and opinions are exchanged. And among the subjects in the public mind today public utilities and engineering in general are both prominent. This being the case, it is essential to the advancement of utility service to the public and it is invaluable to the general usefulness of engineering that the public be provided with proper facts so that thoughts and words may be based on truth and not conjecture.

Too often are public utilities and too often are engineers ineffective, hesitant or even backward in telling the truth about their services to the public. The wily and knowing politician is not so hampered and often rides to office on arguments accepted by a misinformed public to its own ultimate detriment. Yet there lies within the power of the utility the same strong weapon used by the politician —publicity—and it should prove the more effective when it is used to tell the truth.

The utility story fairly, fully and frequently told is the best preventive political medicine known. It is worth while telling all the time, continuously and consistently. A public which thinks correctly is much more likely to act correctly when the time to act arrives than one which is either uninformed or misinformed. The human mind is constantly at work, and it is both useful and legitimate to feed it facts upon which to chew.

Henry Duvall James

An executive engineer who has contributed largely to the development of industrial control apparatus.

IN THE industrial applications of electricity a necessity arises so to control the energy or the electrical machines that maximum speed in production and safety to operators will result. One of the younger engineers of the industry who has attained leadership in this type of work and who devotes his energies enthusiastically to further developments in all lines of control is H. D. James. He organized the control engineering department of the Westinghouse Electric & Manufacturing Company and has been and is the first and only manager of this department. He has received about one hundred patents on control systems and has been a prolific, authoritative writer on phases of control, both in the technical magazines and as the author of a book entitled "Controllers for Electric Motors."

Mr. James was born in Baltimore on Sept. 21, 1874, and was graduated from the University of Pennsylvania in 1895, receiving the degree of bachelor of science and a year later the post-graduate degree of mechanical engineer. Soon after his graduation Mr. James entered the employ of the Otis Elevator Company, working at times in Yonkers, N. Y., New York City and Pittsburgh. In this service he received some of his first training and experience with control apparatus. He entered the employ of the Westinghouse Electric & Manufacturing Company on Feb. 1, 1904, and has been with it continuously since. In 1909 he assisted in the organization of the general engineering department of the company and seven years later in the organization of the control engineering department, which up to that time had been a division of the general engineering department. He was appointed manager of the new department in recognition of his efforts and his qualities of leadership. In 1919 he also assisted in the reorganization of the entire sales department of the Westinghouse company.

Mr. James' ability has been recognized by his associates in the electrical industry, as has been evidenced by the fact that he was elected last winter to the presidency of the Engineering Society of Western Pennsylvania, this honor coming to him after he had spent three years as a director and two years as vice-president of this organization. He was also chairman of the sub-committee of the Electric Safety Conference that drew up the safety standards for control apparatus, is chairman of the Control Section of the Electric Power Club and chairman of the industrial power committee of the A. I. E. E. He is secretary of the Westinghouse Club and one of the original fellows of the A. I. E. E.

Editorial Comment

Electrical World, April 7, 1923

Volume 81 Number 14

What Can the Consumer Afford to Pay for Electric Service?

SCANT sales of electrical energy will be made to residential customers so long as electric service is sold as a necessity. But there is no definable limit to the individual's expenditure for those things which tend to make life more livable and enjoyable; and the more the sale of electric service for the convenience and pleasure of the customer can be made the guiding principle in central-station residence sales, the more valuable will the residence consumer become as a customer.

It is only in recent days that the residential customer has been considered much more than a user of some light and some appliances; and it is rare to find a central-station commercial organization that visualizes its residential customers as customers are visualized by the automobile industry and by many other commercial concerns that emphasize convenience, style, comfort and luxury as well as utility and necessity. That lighting is still considered the principal home use of electricity is shown by the fact that the average residential bill is still under $30 per annum! Two central-station managers recently even declared their customers extravagant, though there were no abnormal bills—there was merely a rather unusual number of appliances and large-sized lamps were used! The consumer realized the comfort and luxury value of electric service whether the central-station man did or not. These customers had their automobiles and other modern comforts and considered electric service in the same class.

Naturally no definite answer can be made as to what proportion of his income the average consumer should pay for electric service. But a careful analysis of what most consumers can afford to spend with the central station for the improvement of their living conditions will reveal surprising possibilities. A little more imagination on the part of the central-station commercial man will lead both to better business and to better good will toward electric service.

Keeping Contact with Power Customers

EVERY time a new power customer is obtained a potential source for good or bad public relations is created. Servicing central-station power supply is just as essential as servicing appliances, but there are some critical dissimilarities in the personnel and methods needed for obtaining the same results in the two cases.

In general some high-grade sales engineer has convinced the power customer that he is following a path pointed to by both economic and engineering considerations when he signs a contract for central-station service. Too frequently the existing operating force of the power customer's installation of engines and boilers has not been "sold," and in such cases it remains to oppose and obstruct or is summarily dispensed with, leaving the power customer with no engineering staff. In other instances, even when the existing power engineering staff is "sold" on central-station service, the type of engineering work necessitated under new operating conditions imposes on it a handicap which often leads to trouble and ill feeling.

To offset and prevent such conditions the central-station power salesmen are finding it necessary to act as advisory engineers to the large power customers and to afford them "standby" engineering service. As an organization efficiency move and to bring sufficient technical skill to bear, several companies maintain a small sales engineering force to keep and maintain specialized contact with power customers. One man will handle steel mills, another machine shops, still another large elevator apartments. Many direct advantages result from this practice in the way of obtaining more power load, better power factor and better operating practice, but the indirect advantages of the practice are even more valuable. No surer way exists for maintaining good relations with influential industrial groups and with the engineering personnel outside the central-station organizations. So evident has this become that the practice adopted by some central-station organizations is being widely accepted by others. If the maximum results are to be obtained, the personnel of the advisory staff must be of a high grade and technically competent.

Electrical Contractors to Be Guided by a Commissioner

THERE are times in the affairs of nations as well as of men when it becomes expedient to place the destinies of the nation or of men in the hands of a single individual. Cabinets or boards are not so expeditious or so efficient, and in not a few instances experience has shown them to be long and narrow and to be composed of wood. A competent individual clothed with the requisite authority and power can bring order out of chaos more quickly, and if he be wise and prudent can couple satisfaction with order and sometimes do much to insure contentment and happiness for a nation or a people.

Taking a leaf out of history, modern business, too, when faced with crises, schisms or dilemmas, now turns to a single individual for guidance or chastisement. Thus baseball has its Landis, the motion-picture industry its Hays, the stage its Thomas, the garment center its Mosessohn, and now the electrical contractors of Greater New York are to have their Eidlitz. For causes too numerous to record, reputable contractors of the metropolis doing an annual business of approximately fifty million dollars have found their occupation becoming unprofitable and rapidly losing every vestige of good will. It will be Mr. Eidlitz's job to rectify this situation. There is no doubt of his competency;

he was the organizer and the first president of the National Electrical Contractors' Association and has been singularly successful in the electrical contracting field. His colleagues have certainly shown great confidence and faith in his ability by voluntarily asking him to serve as the commissioner for them and agreeing to place all their records before him and abide by his decisions. All who are acquainted with the electrical contracting conditions in the Greater City and who know Charles L. Eidlitz will commend the choice. The only way in which he can enforce his decisions is by moral suasion, and while time and experience alone can reveal how successful Mr. Eidlitz will be in exercising his functions as commissioner, he at least begins his labors with the confidence and well wishes of the industry. If the arrangement does not work out well, the fault will not be his. He possesses courage, initiative and an intimate and practical knowledge of the business, and he has reached the age when passion and prejudice will not sway him and where he can be influenced only by what is right and just.

Take Steps to Give Code Changes Status of American Standard

THE National Electrical Code, changes in which were recently adopted by the electrical committee of the National Fire Protection Association, is essentially a standard of electrical construction, installation and operation, according to which insurance companies judge the insurability of electrical equipment or of buildings in which electricity is used. It has been compiled by the electrical committee and is administered by insurance inspectors, municipal and state inspectors.

In the past the electrical committee has revised the code biennially, after suitable public hearing, and the recent revision was made in this way. But meanwhile the code itself was adopted, by due procedure, as an American standard by the American Engineering Standards Committee, which has a very definite procedure for revisions of its standards. There is now therefore the anomalous, though in this case natural, condition of an American standard code containing revisions which are not American standards. It surely appears that it would be most advantageous to take immediate steps to give the new revisions official status. This could be done practicably, it seems, by some action which would in effect make the present electrical committee, with slight modification, serve as the necessary sectional committee under appropriate sponsorship. The present electrical committee is composed of representatives of the following associations: American Electric Railway Association, American Institute of Electrical Engineers, Associated Factory Mutual Fire Insurance Companies, Association of Electragists International, National Association of Electrical Inspectors, National Board of Fire Underwriters, National Electric Light Association and the United States Bureau of Standards, and representatives of the inspection bureaus of some of the large cities of the country and of certain other interested bodies. This looks like a good foundation for building a sectional committee, and if modifications are made permitting better balance between men who represent electrical associations and insurance men, so that it will be more apparent that the electrical industry itself bears the principal burden of the preparation of the code, such a committee should be fully qualified and should have the full confidence of the industry. In short order the latest changes would be made changes in the American standard and present and future code work would receive an even higher status both legally or strategically and in the estimation of those who conduct their operations according to its precepts. It is to be hoped that some organization will immediately take proper steps to bring this officially to the attention of the American Engineering Standards Committee.

One-Million-Volt Laboratories

PROGRESS in any art is dependent on discovery, which in turn is dependent on experiment and scientific investigation. This is particularly true of the art of electrical engineering, in which the underlying laws are not visible in their operation, but only in their results, and in which new laws are being uncovered almost daily. The promise of results from study and investigation in such a field is therefore immediately obvious. But this promise has not always been generally recognized. The early history of the development of electrical machinery reveals clearly the intimate relation between improvement and foregoing experiment. There followed, however, a long period in which investigation was practically limited to the technical development of machinery embodying a few great underlying principles, such as the generation of electromotive force by electromagnetic induction, leading to the continuous and alternating current generators and motors and their extension into the simpler problems of transmission. Investigation in this period was generally of the cut-and-try type, the finding of some new material or method of design that would work a little better. In fact, nothing more was needed. The field opened by the successful production of generators, motors and the incandescent lamp was so wide that manufacturers had all they could do to supply the market and improve the efficiency and reliability of existing types.

The change came with the wider demand for the benefits of electric service and the necessity for long-distance transmission. This immediately emphasized the limitations of our knowledge of the number and variety of electrical laws and of the phenomena involved in the transmission of both intelligence and power. At first the tendency was to stick to the old method of empirical effort in solving these new problems. As time went on, however, the inadequacy of this policy was seen, and the importance—in fact, the necessity—of calling upon the best type of scientific investigation was recognized. Laws must be understood before the properties of materials in relation to these laws can be intelligently studied and utilized.

This truth once realized has spread apace, so that now the most elaborate research laboratories are to be found in the manufactories rather than in the universities, their original homes. The industries are voicing the importance of research with great emphasis and are expending large amounts not only in equipping laboratories but in maintaining them in active operation under experts in various fields. In one electrical laboratory of this type the number of employees engaged solely in research reaches well up into the hundreds. The magnitude of the investment placed in these undertakings, which is evidence of the importance attached to scientific research by the management, is indicated by the description of the new high-voltage laboratory of the Westinghouse Electric & Manufactur-

ing Company printed in the ELECTRICAL WORLD this week. This is only one phase of the research work of this company, yet its importance evidently justifies a separate laboratory, covering considerable ground area, special railroad connection and loading facilities, elaborate protective and control devices for the electrical equipment, independent motor-driven generators entailing a total substation capacity of 3,000 kva., liberal provision in the way of clearances, oil tanks, piping, driers, etc., for all types of high-voltage testing, and finally two testing transformers for 1,000,000 volts and 500,000 volts respectively. Of special interest are the several methods provided for the accurate measurement of these high values of voltage and the principles followed in designing the high-tension insulation of the transformers.

At first thought one wonders what, with transmission voltages at a temporary standstill at 220 kv., are the special purposes of these elaborate preparations for study in a field so far beyond the apparent maximum of present practice. The answer is that provision is being made not merely for the testing of insulators, but for the study of laws and the properties of materials in ranges well beyond those of practice, so that reliability against unknown dangers may be provided, efficiency of operation improved and new laws uncovered, and possibly even in anticipation of transmission voltages still higher than any yet mentioned.

The Graphic Design of Illumination

SINCE scientific lighting became familiar, numberless efforts have been made to reduce the design of illumination in any given working space to the simplest possible terms. The methods of attack on this problem have in general been two—one the method based on the flux of light within the space as a whole and with the introduction of such modifying factors as might be necessary, the other a simplification of the old point-by-point reckoning with the intensity and polar graph of the source as a base. The experience of engineers has long ago shown that each of these methods has merits in particular cases. It has disclosed further the fact that both methods must in a good many instances be supplemented by intelligent judgment or computation. The concrete problem which the illuminating engineer has to face is not the illumination of a space of given dimensions but the illumination of a space of given dimensions devoted to particular specified uses—a final requirement which alters the situation very materially.

A good example is found in the report on the lighting of post offices which we published March 24. Here it has to be taken as one of the fixed conditions of the problem that the illumination must be at a sufficient working intensity for both horizontal and vertical planes and for conditions of visibility by no means normal in other clerical work. This matter aside, it is certainly convenient to have both the flux and the intensity method developed in the simplest feasible way, and the charts devised and explained by Emil Kun, which we publish this week, will afford for certain cases relief from serious computations. The object of the method is to take a short cut to the long series of the point-by-point method through the introduction of a primary plane of lighting determined in the conventional way from the polar curve or actual performance of a typical lighting unit, and then to pass graphically in a way that is clearly explained to the lighting on other and secondary planes that may be necessary for reckoning the whole equivalent illumination. As the reckoning starts from the polar curve of a typical luminaire, or the actual results obtained from it, and then passes to the illumination on one or more planes, the graphic method may be reversed to determine the height of fixture or necessary intensity from the illumination at the primary and secondary planes concerned. Methods of this sort are not infrequently convenient and furnish a useful check on computations made in other ways.

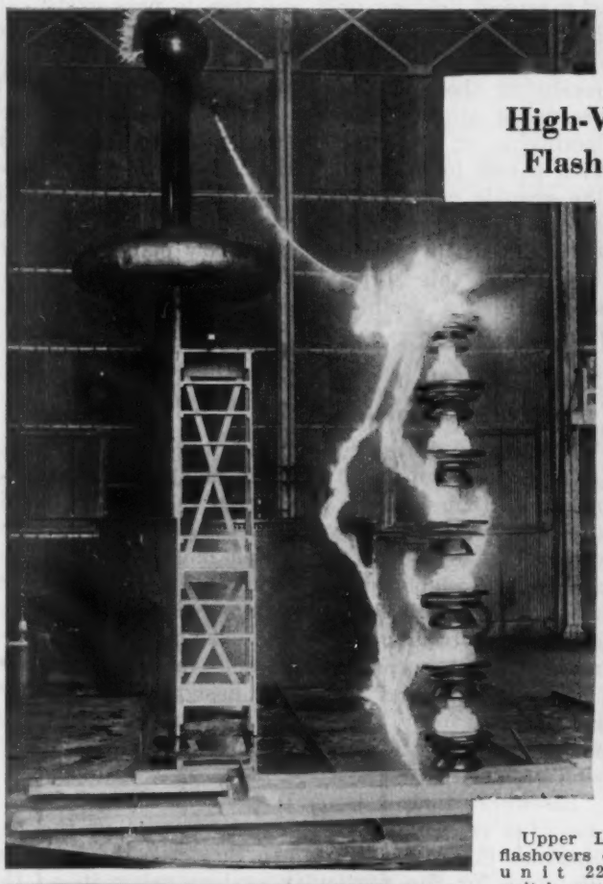
Making the Most of the Calculating Table

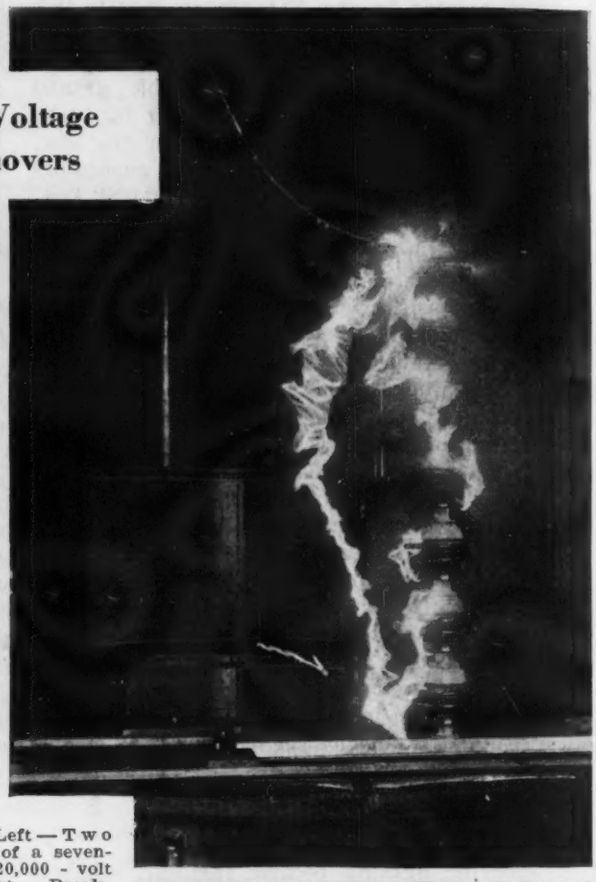
FEW devices have contributed more during the last few years to operating refinement in transmission networks than has the calculating table. Through its use relay settings have been made more accurate, circuit-breaker duties have been more closely defined, and immense labors in the computation of short-circuit values have been reduced to comparatively easy manipulations and tests of electrical system models. These results have been attained at relatively low cost where "home-made" tables have been designed for a particular system, and this is a strong argument for the wider application of this method of analyzing transmission problems.

Elsewhere in this issue E. W. Dillard describes the use of a calculating table on the system of the New England Power Company. In this case the table was designed for the particular system using it, so that the flexibility that is characteristic of tables adaptable to any system layout was omitted to save unnecessary expense. Structural simplicity marks the Worcester table and accessories, but these are sufficient to enable careful studies to be made of proposed extensions or changes in lines, transformers and generating stations in relation to the existing network. The company's engineers are to be congratulated upon their solution of the problem of providing an outfit so well combining compactness and simplicity with adequacy for determining short-circuit currents and the requirements of relay operation at any desired point on the system.

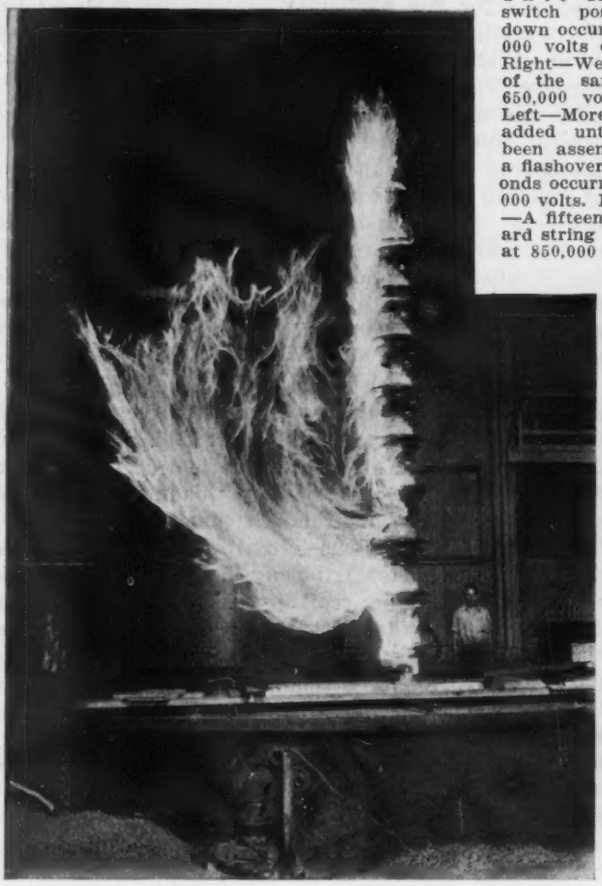
Interesting as such devices are to the engineer, there remains the natural query of the executive, "What have they actually accomplished?" Mr. Dillard shows that the solution of the important problem of relay setting has been made much easier by this means and that, as a result of the analysis, the amount of energy to be handled by various circuit breakers has been decreased, thereby contributing to more reliable service and postponing the replacement of earlier installed designs of oil switches. During low-water conditions the company is sometimes obliged to shut down a large part of its hydro-electric equipment, but since this shutting down must be limited by the number of machines required to furnish sufficient energy for relay operation, accurate information as to relay settings is most valuable. More satisfactory knowledge of circuit-breaker requirements in extensions and changes is also available through table tests. All this spells economy of plant investment and efficiency in operation and suggests the value of this method of investigation to far less complex systems than that of the New England Power Company and its interconnected lines.

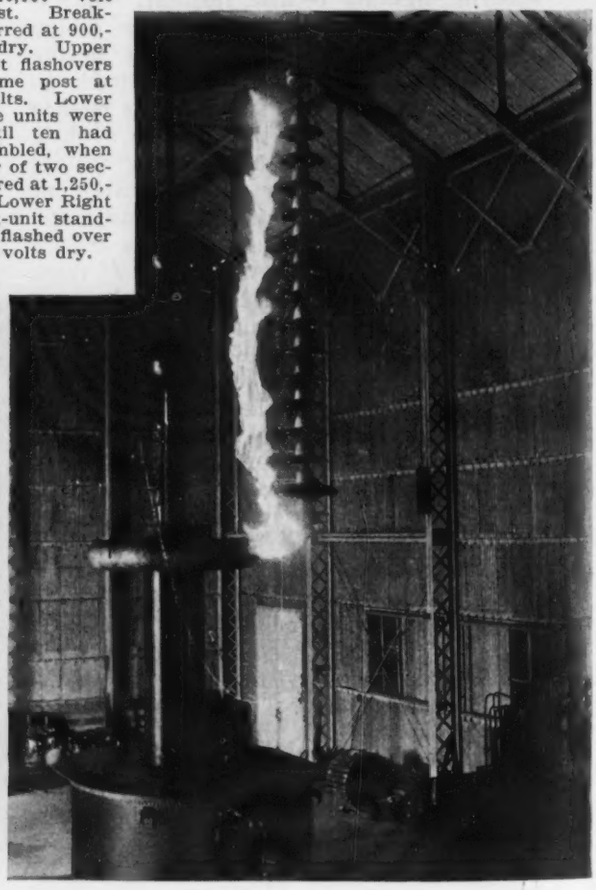
High-Voltage Flashovers





Upper Left — Two flashovers of a seven-unit 220,000 - volt switch post. Breakdown occurred at 900,000 volts dry. Upper Right—Wet flashovers of the same post at 650,000 volts. Lower Left—More units were added until ten had been assembled, when a flashover of two seconds occurred at 1,250,000 volts. Lower Right—A fifteen-unit standard string flashed over at 850,000 volts dry.





Complete Million-Volt Laboratory—Part I

A Thoroughly Equipped Experimental Station Devoted Exclusively to Research Problems in the Use of Very High Voltages and Which Includes a Single-Unit 1,000,000-Volt Transformer

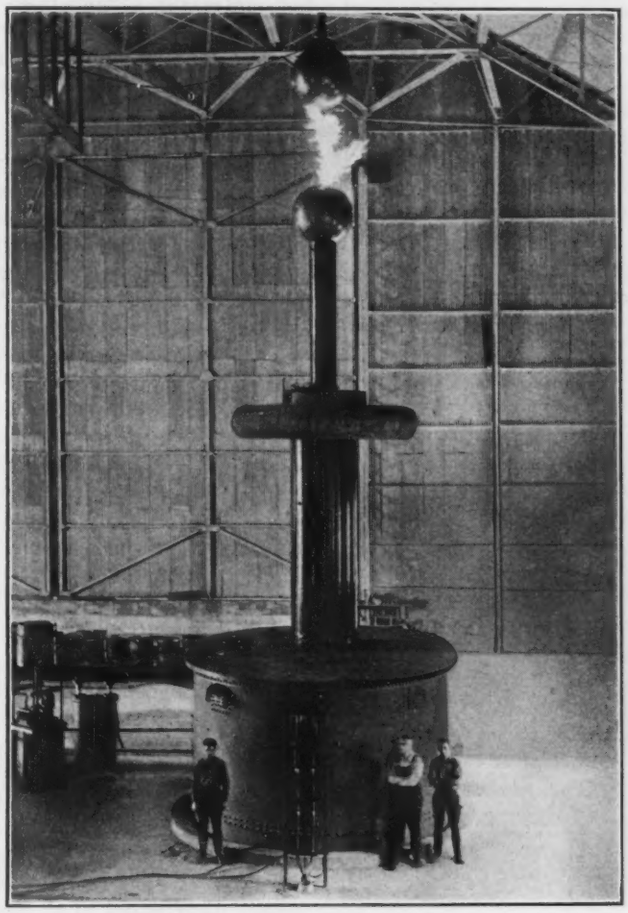
By J. F. PETERS and D. F. MINER
Engineering Department, Westinghouse Electric & Manufacturing Company

INDUSTRIAL progress of towns, states and whole nations has become largely dependent upon electric power made low in cost and instantly available. In the United States, because of its great natural resources, large electric systems have grown in capacity and territory served, making available enormous power for electric transportation and development of industries.

Apparatus built for these systems, the voltage of which has climbed higher and higher as economy in transmission of the greater blocks of power has dictated, must be made far more reliable than was necessary when small isolated systems dotted the country. Test voltages for existing apparatus must be provided up to approximately 700,000 volts. Suspension insulator strings, which have sufficient insulation under severe storm conditions for the present 220,000-volt systems, will have a dry flashover voltage around this value. While there is no immediate prospect of need of transmission-line voltages much in excess of 220,000 volts (127,000 volts to grounded neutral), testing facilities for research studies must always be kept far in advance of actual practice.

There is urgent need of thorough investigation of high-voltage problems to obtain data upon which engineers may with confidence design apparatus for installations the magnitude and voltage of which may exceed our present upper limit. These may be demanded sooner than we anticipate. Furthermore, we need information which will help in the solution of difficulties which arise at times in the operation of the present systems.

Because of the expense involved in providing necessary special equipment and maintaining a competent corps of experts, the larger electrical corporations are at present the only ones especially fitted for carrying on this work. Without the expectation of immediate returns, they may spend large sums for these investigations, knowing that the results will ultimately be applied to future equipment to be manufactured. The Westinghouse Electric & Manufacturing Company, early identified with research in high voltage engineering, has, in line with this policy, built and equipped a large laboratory exclusively devoted to high-voltage research and development.



COMPLETE MILLION-VOLT TRANSFORMER, BUSHING AND SPARK GAP WITH A FLASH OVER THE GAP AT 1,200,000 VOLTS

The main laboratory, having a floor space of 110 ft. x 120 ft. and isolated from near-by shop buildings, is equipped with two testing transformers, one for 1,000,000 volts and the other for 500,000 volts. In addition, two large oil tanks with auxiliaries are provided, one for tests of insulation under oil and the other for rain tests of bushings and similar apparatus. The building is so constructed that a clear space of 50 ft. exists from the floor to the lower chords of the truss, giving an unobstructed volume (110 ft. x 120 ft. x 50 ft.) and affording plenty of clearance for the very high potentials used.

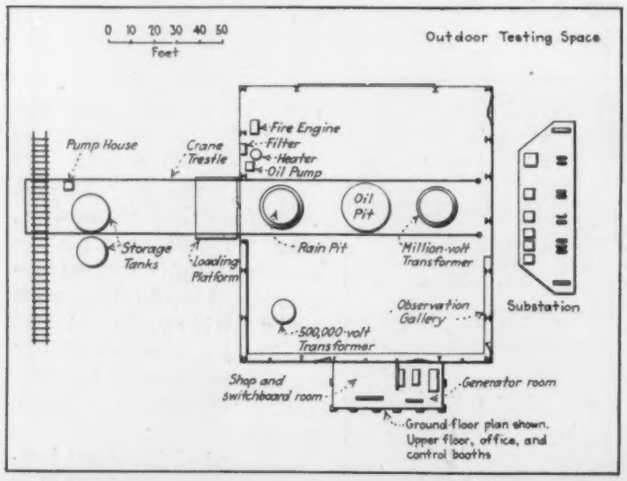
Attached to one side of the main building and partly separated from it by a glass partition is the operating and control building. On the ground floor of this structure the generating equipment, low-voltage switchboards and work shop are installed. On the upper floor are the two transformer operating booths, remote breaker control bench and the office.

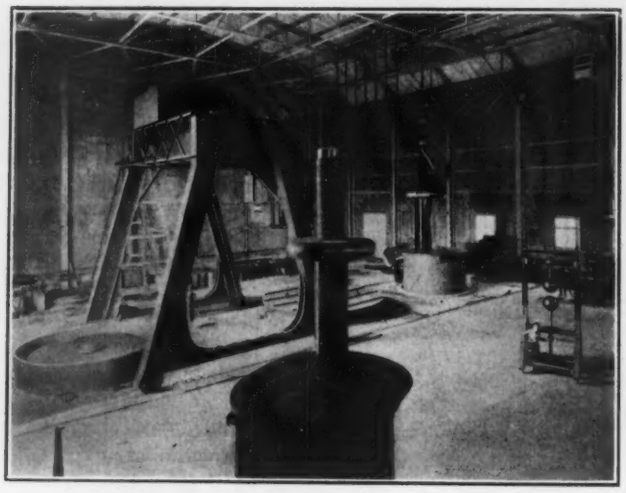
Adjacent to the building, a substation, with the necessary circuit breakers and supply transformers, has been constructed.

On the side of the building opposite the control room two sliding doors may be opened, giving a space 45 ft. x 60 ft., through which high-voltage lines may be taken for outdoor tests.

The question of material handling, so important in industrial plants, offered special problems in this laboratory, for it was desirable that proper facilities be provided for bringing in and setting up apparatus under test, which is usually of considerable size, and for re-

pairs or additions to permanent equipment. For this reason the two large tanks and the million-volt transformer were placed in pits sunk in the floor on a line through the middle of the building. These pits are straddled by a gantry crane of 35 tons capacity with a 5-ton auxiliary. The crane track passes out of the building through a double door, 25 ft. x 45 ft., to a concrete loading platform, and from there out on a trestle over a siding of the Pennsylvania Railroad





INTERIOR VIEW OF THE LABORATORY AND GENERAL LAYOUT; 500,000-VOLT UNIT IN FOREGROUND

tracks. Inside the building transfer at right angles to the crane track is accomplished by means of an electric monorail trolley hoist.

The history of high-voltage testing transformer development shows a progress by steps, keeping pace with improvements in insulation. When the limit of voltage capable of being produced in a single unit was reached the next step was to use two or more transformers in series. When further progress in insulating structures came a return to the single unit was made. This cycle has been traversed several times. In 1891, when potential transformers had reached a limit, a set using several units in connection with an insulating transformer was constructed by C. E. Skinner and C. F. Scott. The next cycle was completed in 1913 by the Westinghouse company, when two 500,000-volt transformers were connected with the common point grounded to produce 1,000,000 volts. During recent years the use of several units in cascade has been advocated, and now again a single unit has been possible.

The present million-volt transformer built by the Westinghouse company represents a real advance in the art brought about by the construction of a single unit for the total voltage. The advantages gained by this construction, involving as it did the solution of serious problems of insulation efficiency and careful stress distribution, are saving of space, convenience of operation and accuracy of voltage measurement.

The new million-volt single unit utilizes insulating space at such efficiency that the whole transformer is not materially larger than an older unit for half the voltage. The new principle, in a word, is the adoption of coils increasing in size and voltage radially instead of axially. The first high-voltage coil starts at ground potential and need not be heavily insulated from the core. Each succeeding coil is at a higher potential and requires greater insulating distance. However, the difference of potential between any two coils is not great and the necessary insulation is small. All these factors lead naturally to the construction used. The high-voltage (secondary) coils are wound on insulating tubes of increasing diameters and decreasing length so that each coil fits inside the next high-voltage tube. The outermost micarta tubes were larger than any previously made and required special mandrels for rolling. The coils are divided into two groups on the two legs of the iron core. Each group consists of seventeen of these nested coils. This arrangement automatically places the coil with the highest voltage furthest from the grounded core. The primary winding, as would be expected, is placed also on a tube immediately surrounding the core.

STRESS IS UNIFORMLY DISTRIBUTED

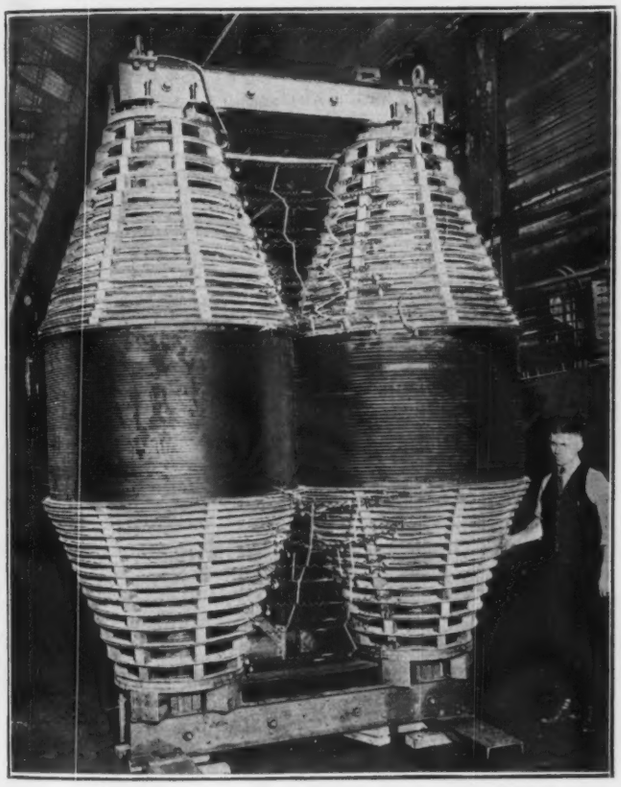
Such an ingenious design, a noteworthy achievement by Westinghouse transformer engineers, accomplishes another purpose just as important—the distribution of stress uniformly throughout the winding. To illustrate: If a number of sheets of insulating material were stacked together and a high voltage applied to the top and the bottom connected to ground, the top sheets would assume the greater part of the stress and might indeed fail. The inner portions would not be doing full duty at all. In other words, the stress is not uniformly distributed to all parts throughout the thickness. The most severely stressed material is in danger of failing and that lightly stressed is used inefficiently. Now, if we place metal sheets between the insulating sheets, forming a pile of electrostatic condensers, we find that the stress load is nicely distributed. This condenser principle was discovered by the Westinghouse company and incorporated in transformer terminals known as condenser bushings many years ago. These bushings consist of rolled layers of paper and foil.

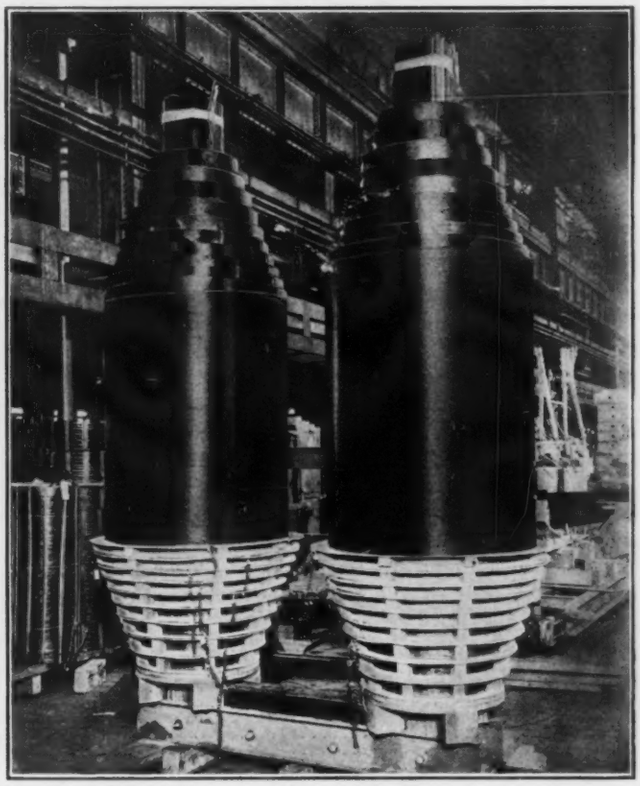
The use of the same arrangement has been accomplished in the design of the million-volt transformer and makes possible the construction of a single unit for this voltage with reasonable dimensions. Instead of the metal sheets as in the analogy or foil as in the bushing, the windings themselves form the metal condenser plates. The two ends of each coil (equivalent to a metal cylinder) are not far different in potential, and the tapering difference is exactly matched by similar conditions in the next coil both inside and outside. In order to provide perfect distribution, the area of the condenser elements must be nearly equal. There-

fore, as the diameter increases, the length of cylinders is made correspondingly less.

SAFEGUARDED AGAINST FAILURE

Spacing strips are placed between the cylinders to maintain a concentric position and preserve rigidity. There are two paths by which failure might take place between two parts of a transformer, one by direct puncture of the intervening insulation and the other by creepage along surfaces and over edges. In this transformer the insulating tubes and space filled with oil between tubes protect against puncture. Creepage is prevented by the addition of fullerboard barriers in the form of angle rings which are placed over the ends of the tubes. The use of these offers such a long insulating path that creepage over the edge is prevented.





CONSTRUCTION FEATURES OF TRANSFORMER COILS

Left—The high-voltage secondary coils on the million-volt unit are wound on insulating tubes of increasing diameters and decreasing length so that each coil fits into the next high-voltage tube.

Right—Failure is prevented by filling the insulating tubes and intervening space with oil, and creepage is prevented by placing angle-ring fullerboard barriers in the ends of the tubes.

Another insulating feature which is important is the protection of coils against surges. Severe testing conditions often result in the sudden release of large energy. This impulse or voltage shock may cause these outer coils to break down and flash over from one turn to the next in an attempt to absorb the energy. A great difference of potential is formed between adjacent turns.

For this reason the outer few coils are wound with heavily insulated cable, and coils farther inside are wound with string separating the wires, to offer greater insulation between turns. The line coil is wound with ⅛-in. copper with treated cloth insulation $\frac{3}{32}$ in. thick. After the coils are placed on the core legs they are connected in series to add the potential of one to that of the next. Thus the end of No. 1 coil, on one leg, is connected by the beginning of No. 2, which is the first on the other leg. The end of No. 2 winding goes to the beginning of No. 3, which is on the same leg as No. 1, and so on, alternating back and forth until all the coils on both legs have been connected in series. The end of the thirty-fourth coil is then attached to the wire going to the terminal bushing and thus to the outside.

The transformer tank, which is 13 ft. in diameter by 15 ft. high, is equipped with a special barrier to prevent failure from the transformer coils to the tank. The inside of the tank is lined with many layers of ¼-in. fullerboard, separated by oil spaces. This provides an effective insulator outside the transformer. It will be recognized that the outer coils, at a potential of a million volts, must be insulated, first, from the transformer core, which is at ground potential, and, second, from the tank, which is also at ground potential.

However difficult it may be to produce a potential of a million volts with a single transformer, it is a greater problem to control and direct this voltage at the terminal. It is one problem to induce this high voltage in the coils and another to bring it outside the tank to be put to some useful purpose. In some existing high-voltage transformers this difficulty is met by placing the transformer in a very large tank of oil, omitting the tank cover and providing a bushing emerging from the surface of the insulating oil. This, of course, leaves the oil open to moisture and dirt and is to be avoided if possible. With a metal tank and cover, the bushing must withstand the million-volt stress between the central conductor and the grounded flange.

Any solid or continuous dielectric interposed in this location would be unsatisfactory, for the unequal distribution of electrostatic stress throughout the cross-section would cause progressive failure. A bushing

utilizing the series-condenser principle of potential gradient equalization was adopted as the only feasible means of bringing the terminal through the cover with a proper factor of safety. This bushing, the largest of its type ever built and the highest voltage bushing in existence, is calculated to be capable of withstanding double transformer voltage, or 2,000,000 volts, for short intervals, imposed upon a radial insulation thickness of less than 18 in. In the factory the largest rolling equipment was too small for this bushing and had to be remodeled. Much greater length and radial dimensions had to be provided, as well as greater strength of head and tail stock to support the extra weight.

The methods used in construction were the same as in any condenser bushing, except that weights of material and dimensions broke all records. The central mandrel of the bushing is made of double extra 6-in. steel pipe. This pipe was carefully turned true and when finished weighed over 1,000 lb. On this pipe were wound the insulation and metal foil. The insulation consists of special treated paper about 0.005 in. thick and 3 in. wide, wound in spiral layers the length of the tube. At intervals as the diameter increases a layer of metal foil wound in a 5-in. spiral strip is added. During the rolling the strips, which are under tension, pass over an electrically heated surface which drives out any traces of moisture and liquefies the coating of the paper so that the layers are cemented together.

The next step was to turn off the ends of each of the hundred layers. The area of condenser cylinders in the bushing must be equal for correct potential distribution. Therefore, as the diameter increases the length is made to decrease. With equal thickness of paper layers the length of cylinders should be a logarithmic function. Ordinarily, a straight conical tapering of the bushing ends is so close to the theoretical curve that the difference is inappreciable. In this million-volt bushing, however, the dimensions are so large that a line drawn through the ends of the steps has a decided curvature.

TABLE I—TRANSFORMER STATISTICS

Number high-voltage coils	34
Total number turns in secondary	36,000
Total length of wire on secondary, miles	70
Primary voltage	5,000
Secondary voltage	1,000,000
Diameter of tank, ft.	13
Height of tank, ft.	15
Rating, kva.	1,000

To provide proper creepage distance over the surface, the hundred layers were stepped off gradually on the upper end, which will be in air, and more abruptly on the lower end, which is to be immersed in oil.

After the rolling and turning had been completed, the bushing was ready for the addition of the metal parts. Banding wire was first wound around the portion of largest diameter, and a cast-iron flange, by which the bushing is supported on the tank cover, was cemented on. A few inches below this flange, at the lower end of the straight section, an iron ring was cemented on to provide mechanical protection when the bushing was laid down. Some idea of the size of the whole unit may be obtained when it is noted that this simple protective ring weighs 150 lb. The lower end of the bushing was fitted with a static shield in the shape of a doughnut which serves to produce a proper distribution of stress around the terminal under oil. The upper end of the bushing was finished with a lifting cap. An insulating tube ¼ in. thick was placed over the top end of the bushing, and the space between this tube and the tapering bushing was filled with insulating gum to prevent entrance of moisture. It is essential that a uniform field be produced between the bushing terminal and the tank cover in order to avoid corona formation and possible flashover of the bushing. The static shield on top is built of wood in shape similar to the lower shield and is covered with sheet metal. It is 10 ft. in diameter and 20 in. thick. Inasmuch as the bushing in this type of transformer is necessarily placed off-center, the usual tank cover would not be symmetrical with the static shield. The cover of the million-volt unit, however, was built with a projecting lip so that a grounded surface concentric with the bushing is obtained. As an added refinement, all manholes and attachments to the tank cover are so fastened that no bolts or other objects project above the flat cover. This prevents corona formation. The finished bushing, exclusive of the upper static shield, weighs nearly 7 tons and contains an amount of material far in excess of any bushing previously designed. Table II shows at a glance the principal weights of this extraordinary condenser terminal.

TABLE II—FINISHED WEIGHTS OF MILLION-VOLT BUSHING

	Lb.
Metal foil	900
Treated paper	6,000
Iron pipe	1,050
Main flange	475
Other metal parts	350
Outer micarta tube	300
Insulating gum	4,300
Total	13,375

Department of Commerce Acts on Radio Recommendations

ACTING upon the recommendations made by the recent radio conference at Washington, printed in the ELECTRICAL WORLD for March 31, page 765, Secretary of Commerce Hoover has made the following classification of wave lengths for internal broadcasting:

Class A stations—that is, stations equipped to use power not exceeding 500 watts. In this class it is proposed that the radio inspectors, in co-operation with the station owners, shall assign distinctive wave lengths to each station so far as is possible in the area from 222 m. to 300 m. No station will be required to change from 360 m. unless it so desires.

Class B stations—that is, stations equipped to use from 500 watts to 1,000 watts. In this class it is proposed similarly to offer to license these stations on special wave lengths from 300 m. to 345 m. and from 375 m. to 545 m., having regard to the maintenance of some ship work on 450 m. as outlined above, and again no station will be required to change from 360 m. unless it so desires.

Class C stations—comprising all stations now licensed for 360 m. In this class no new licenses will be issued for stations on 360 m. until the plan is entirely realized. Stations which do not wish to move under the general plan may remain at 360 m.

Under the plan amateurs are given the whole area from 150 m. to 220 m., instead of being fixed upon 200 m. with special licenses at 375 m. The special licenses hitherto issued for amateurs at 375 m. will now be issued at 220 m.

Operating Characteristics of Rural Lines*

Prevalence of Unusual Conditions Long Familiar to Engineers—Data Now Being Accumulated Indicate the Actual Operating Characteristics—Factors Which Affect Loads

By V. L. HEIN
Engineering Extension Department, Iowa State College

FOR some time engineers in a position to observe the performance of rural tranmission lines have known that unusual conditions prevail, although the absence of actual data has hitherto prevented them from proving this to be so. Now, however, material is gradually being collected which shows the actual operating characteristics.

Since 1919 the engineering extension department of the Iowa State College of Agriculture and Mechanic Arts has been collecting information relative to the electric service given by rural transmission lines. During the past year and a half additional data have been gathered showing power factor, maximum demand, amperes, volts and losses on these lines. Rural lines in different parts of Iowa on which meters were installed were arbitrarily chosen for these tests.

The lines from which the data herein were collected are all of similar construction with the exception of line No. 1, which contains about 6 miles of No. 4 B.W.G. iron wire. They were operated at 6,600 volts to 110 volts, 60 cycles. The meters in every case were connected at the point where power was supplied to the line, so that the total kilowatt-hour input was recorded, thus including the energy actually delivered as well as transformer and line losses. The metering equipment consisted of a fifteen-minute-interval recording-demand watt-hour meter, a graphic voltmeter, a graphic ammeter and the necessary metering transformers. As the metering was all done on the 110-volt side of the transformer, a potential transformer for reducing the voltage and a current transformer for reducing the value of the current were used. This necessitated the use of constants in all calculations for power factor. The values indicated on the demand charts must be multiplied by thirty to obtain the true kilowatt reading.

The demand chart (Fig. 1) shows the great variation

*Published as Bulletin 53 by the Iowa State College of Agriculture and Mechanic Arts.

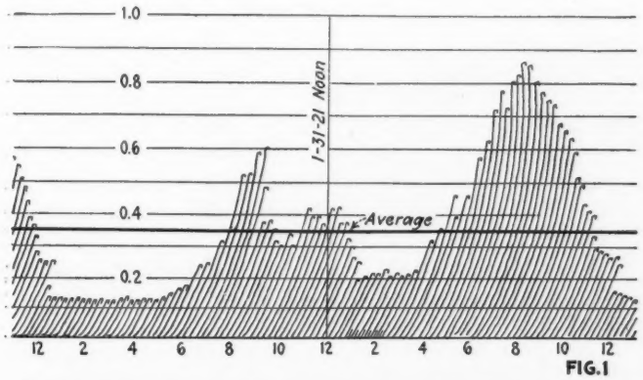
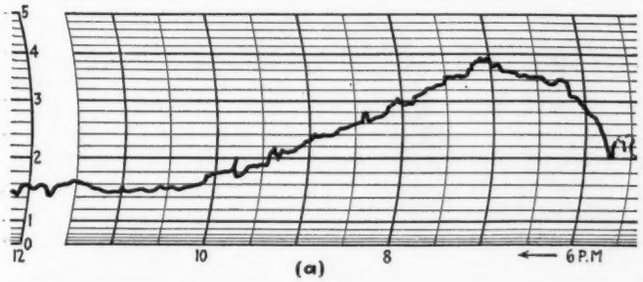


FIG. 1



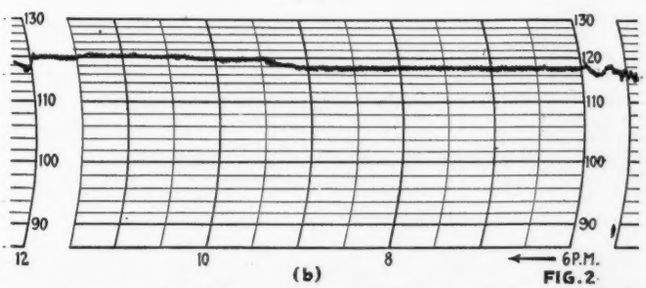


FIG. 2

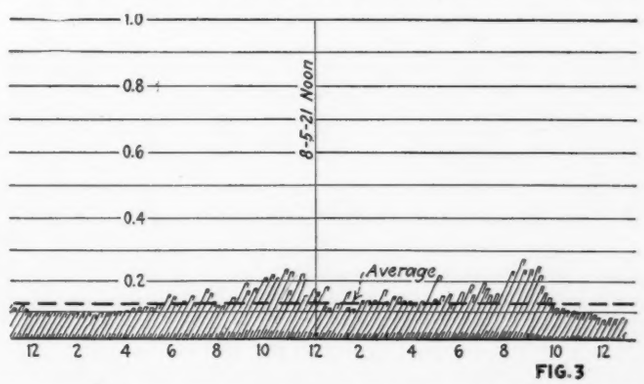
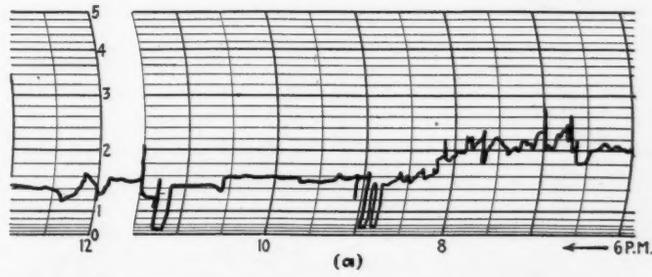


FIG. 3



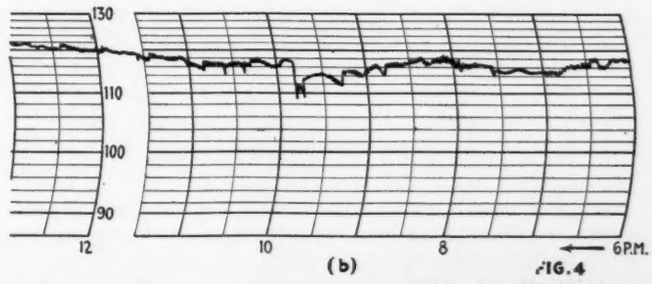
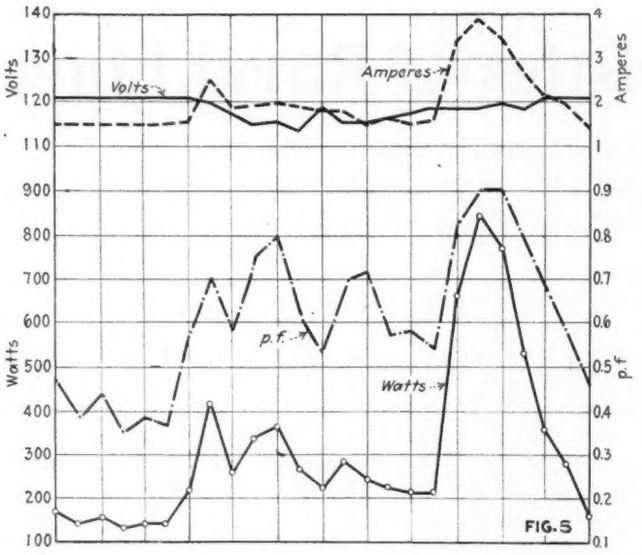
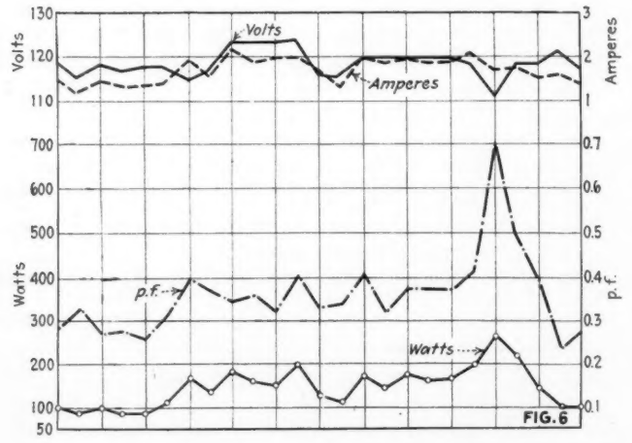
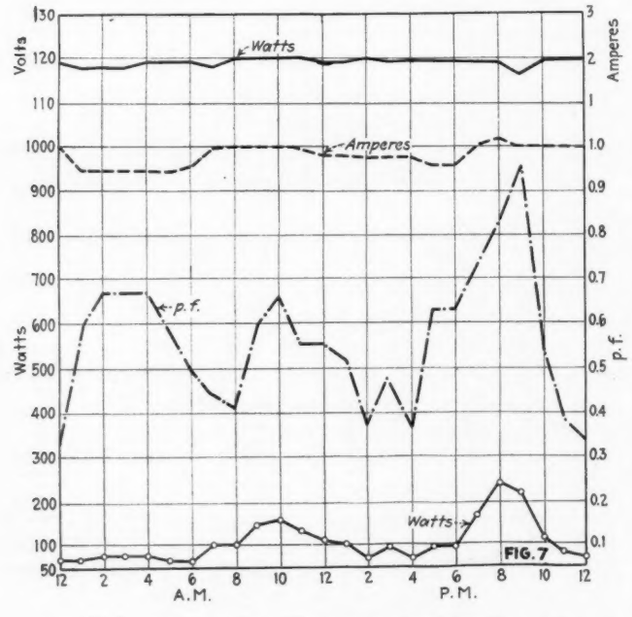


FIG. 4

FIG. 1—KILOWATT DEMAND OVER TWENTY-FOUR-HOUR PERIOD. MULTIPLY BY 30 TO GET ACTUAL KILOWATTS. FIG. 2—(a) AMMETER RECORD, (b) VOLTMETER RECORD. FIG. 3—MONTH OF AUGUST SHOWS LOW DEMAND. MULTIPLY BY 30 TO GET ACTUAL KILOWATTS. FIG. 4—TYPICAL RECORD OF AVERAGE LINE (a) AMMETER, (b) VOLTMETER







FIGS. 5, 6 AND 7—OPERATING CHARACTERISTICS OF LINES NOS. 1, 2 AND 3 RESPECTIVELY

during the day and night of a line serving thirty-nine rural customers and a small town of four hundred inhabitants at the extreme end of the line. This portion of the chart, which is taken from the record for January, shows a peak considerably above the average but which is one-third less during the summer months.

Particular notice is called to the period between midnight and 5 a.m., which indicates a very nearly constant load. The demand during this period is almost identical every night since it represents the line and core losses of the transformers. The indicated values will be found to check very closely with the total loss of all the transformers connected. Attention is called to the losses as indicated on the following charts over this same period.

The demand chart in Fig. 3 taken from a line having forty customers connected is probably more typical of the demand on existing rural lines. Frequently the evening peak is no greater than peaks occurring during the day. Through the winter months, however, the evening peak is always greater. However, when the weather chart shows that the day was cloudy there would be a greater lighting load of longer duration.

By studying a demand chart of the type shown here a great many things may be detected which will indicate at least some of the characteristics of the load. Weather conditions make an appreciable difference in demand, especially during the evening peak, depending upon whether the day is clear or cloudy. It is also of interest to note that on one day each week the demand is greater than on any other day. Observations so far indicate this day to be Tuesday, probably because of the washing-machine and flatiron load. A study of a series of weekly charts will show also a great deal of similarity for the corresponding days of each week. By knowing the connected load the operating characteristics of the different appliances and motors may be studied from their effect on the demand at the switchboard.

The required current and voltage during an evening peak for line No. 1 are given by the charts in Fig. 2. Readings are for the month of January, so naturally the evening lighting load is high. It should be remembered that this line also serves a small town.

Considerable irregularity of current and voltage is shown for line No. 2 in Fig. 4. The power supply for this line is transmitted a considerable distance at high voltage, which probably accounts for some of the irregularity in voltage. While the average current in this case is low, it does not reach the low limit shown in line No. 3.

A better idea of existing conditions can be obtained from the curves in Figs. 5, 6 and 7, showing operating characteristics for each of the three lines. The charts shown above cover the operation for one day, or portion of a day for each. To obtain data that are characteristic of operating conditions of a line, they should be collected over a twelve-month period in order to show seasonal effects.

Average figures are quoted in the table, which is a brief summary of the data collected during a period of several months.

SUMMARY OF RURAL LINE DATA

	Line No. 1	Line No. 2	Line No. 3
Miles of line	22.0	30.0	27.5
Customers	*39	40	49
Number of transformers	32	38	43
Transformer capacity kva. connected	165.5	128.0	87.0
Average transformer capacity kva. per customer	3.6	3.2	1.7
Monthly core loss, kw.-hr.	1,155	1,141	†1,178
Ratio, core loss to energy delivered	1:54	.....	1:18
Maximum kw. demand (fifteen minutes)	33.0	11.7	9.0
Average kw. demand (period of test)	9.45	4.8	3.6
Power factor, average	0.583	0.368	0.591

* County farm included, using 15-hp. motor for grinding and sawing.
† Includes 50 kva. transformer at substation, owned by customers. Master meter on low side of this transformer.

A Practical Calculating Table

Resistance Units Take Place of Reactance of Circuits—Sufficiently Accurate for Practical Purposes– Permits Anticipation of Troubles

By E. W. DILLARD

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THERE have been published in several articles various means for estimating mathematically short-circuit current values to be expected from different combinations of electrical apparatus. These calculations can be readily and quickly made for a system with a simple arrangement of equipment, but when applied to an extensive network the calculations are laborious if an exact solution is required. Various approximations have been offered which are, no doubt, reasonably accurate, but the calculations which must be made on an extensive system, involving many networks, require, even with the fastest approximations, prohibitive time, and such a system with its ever-changing conditions, brought about by extensions, developments and variations in load distribution, necessitates a great number of calculations.

The map (Fig. 4) shows the general location of the New England Power System, and the diagram shown in Fig. 2 represents the reactance values of the apparatus in only a part of the system. The entire system must, of course, be considered in short-circuit calculations.

In this diagram the instantaneous reactance of all generators, the reactance of all transformers and the reactance of interconnecting lines are expressed in terms of percentage reactance on a 20,000-kva. base. The diagram has been simplified as much as possible to be concise and yet to contain all the information necessary in estimating a short circuit at any point on the system. It will be appreciated how enormous a task it is to make one calculation, yet operating experience shows that in the course of a single year thousands of calculations are necessary.

In 1917 the New England Power Company constructed a calculating table to expedite this work. This table consists essentially of a representation of each reactance value shown on the diagram (Fig. 2) by a small fixed proportionate resistance unit. The use of variable resistance units was first considered, but as

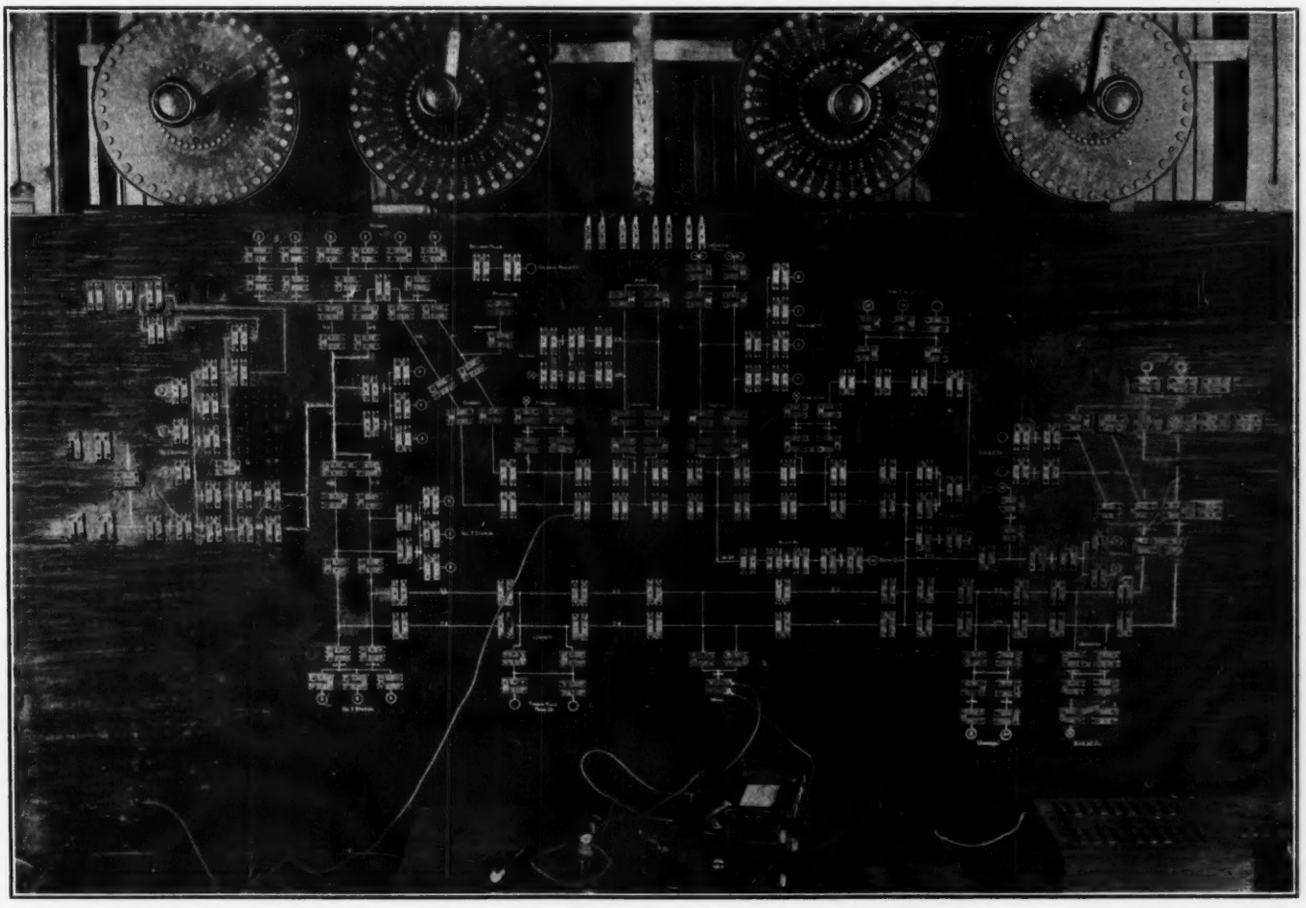


FIG. 1—SYSTEM LAYOUT ON CALCULATING TABLE

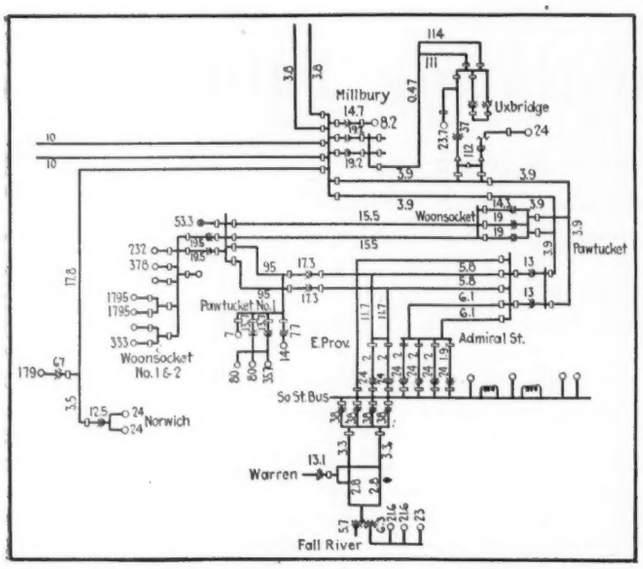


FIG. 2—TO EVERY SECTION OF THE SYSTEM A REACTANCE VALUE HAS HAD TO BE ASSIGNED

This is only one section of the New England Power system, but it serves to indicate the details that must be considered in calculating short-circuit possibilities.

the table was to be designed for calculations on the New England Power Company system only, there seemed to be little justification in abandoning the inexpensive fixed-unit layout for the more expensive, though more flexible, adjustable resistance type.

It was decided to design the table for operation on 110 volts direct current to gain the increased reliability of a moderately high laboratory voltage. The laboratory is equipped with a fifty-cell lead storage battery and a 125-volt direct-current motor-generator set. It was not desirable to use more than about 15 amp. to represent the maximum short circuit to be read on the table, and the resistance units were selected on this basis. The maximum short circuits on the system approximate 750,000 kva., or about 6,600 amp. at 66,000 volts (the primary voltage). For simplicity, it was decided that 1 amp. on the calculating table (110 ohms at 110 volts) should represent 500 amp. at 66,000 volts (57,000 kva.), equivalent to a short circuit of 35.2 per cent on a 20,000-kva. base. Thus, 3.125 ohms becomes the equivalent of 1 per cent reactance on a 20,000-kva. base on the system. Upon this basis resistance tubes were ordered to represent each reactance value shown on the system diagram. These resistance tubes, about ¾ in. in diameter and 6 in. long, were mounted compactly under a large office table and wired to test links on the top so arranged as to represent the actual system connections. Fig. 5 shows the arrangement of some units under the table, and Fig. 1 shows the reverse side. For convenience the table was later mounted in the vertical position shown. One side of each resistance unit corresponding to a generator is connected to the positive lead from the direct-current source; the other side is connected to the units representing transformers, these to the units representing lines, etc. A short circuit is established by connecting the negative lead to the point desired. By closing the requisite test links the system condition under consideration can be established at will and varied, if necessary, while the short circuit remains on. By inserting an ammeter in any line or generator upon the system it is possible not only to read the amount of current flowing through this section but to determine also its direction. It is very interesting and also valuable to be able to follow a complete switching operation through in this manner, determining the magnitude of the initial short circuit with its direction through various tie lines, networks, etc., then determining step by step the sequence of operations for a given relay set-up, and determining the duty imposed upon each oil circuit breaker.

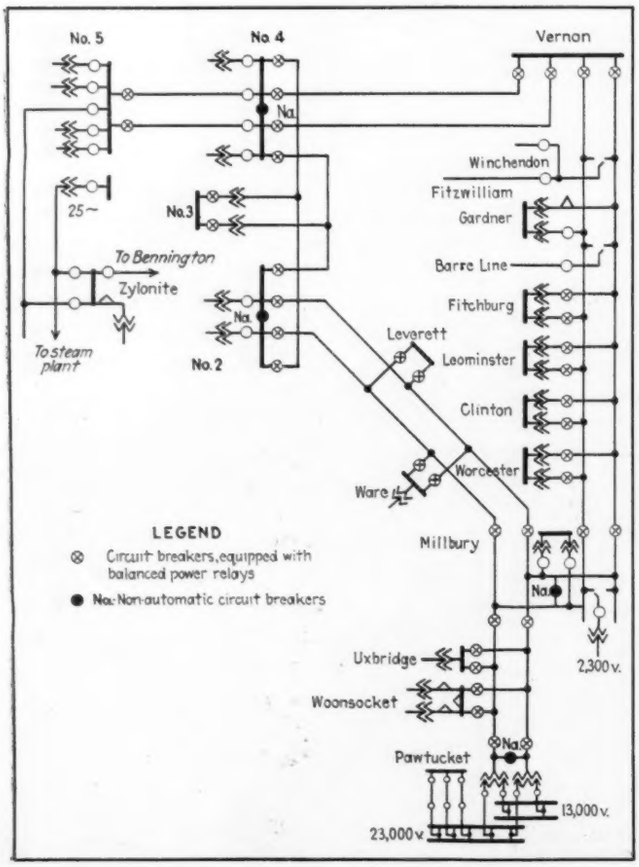


FIG. 3—BALANCED-POWER RELAYS REDUCE CIRCUIT-BREAKER DUTY

VARIABLE RESISTORS USED IN DEVELOPMENT STUDIES

Immediately above the table are mounted four variable pancake resistance units, which are wired to terminals on the top. Each point of these units is calibrated in ohms and also in per cent reactance. There is also a resistance box from which are brought a number of taps. These five variable units, together with a number of spare resistance tubes, are used to represent proposed developments and extensions to the system on the table when such are required for a particular calculation. A small direct-current motor-generator set is generally used for these tests, and there is mounted on the lower left-hand corner of the board a field rheostat to give voltage control to the generator. Since the original construction there have been numerous changes and additions made to the system, and we have been able to change the table to incorporate these additions with very little work.

In short-circuit calculations reactance values are used instead of impedance values, because a closer approximation is obtained when they are added arithmetically. Fig. 6 illustrates the impedance triangles that might be expected when a simple circuit consisting of a generator, a transformer and a transmission line is short-circuited on the end of the transmission line. The line

AB represents the impedance drop of the generator, the line *BC* the impedance drop of the transformer, and the line *CD* the impedance drop of the transmission line, the reactive drops being represented by X_1, X_2 and X_3 respectively. The true short-circuit value would be determined by the line *AD*, but the value of this line cannot be ascertained without a trigonometric calculation. It will be seen that the line *DH* is virtually the same length as the line *AD*, indicating, therefore, that the error in using *DH* rather than *AD* (reactance rather than impedance) is negligible.

ALL IMPORTANT RELAY SETTINGS BASED ON TABLE TESTS

The table is used very extensively in determining the basis for relay settings. No relay setting other than those for unimportant feeder circuits is made unless the values of short-circuit current to be expected under all possible conditions are determined by a series of exhaustive tests. We have found this to be necessary because of the surprisingly wide variation in the extent of short-circuit values during different conditions of load division and plant operation on the system. For instance, during extremely low water conditions it is sometimes desirable to shut down a large part of our hydro-electric capacity, yet this shutting down must be limited to the number of machines required to furnish sufficient energy for the operation of the relays, particularly the switches near the hydro-electric plants. It is, of course, necessary to set the relays high enough to carry the extreme high-load currents of the plants, so we have actually found it necessary to motor machines during low-water periods to give sufficient current to operate these high settings. This fact might have been discovered under rather disastrous conditions had it not been that it was anticipated by exhaustive tests on the short-circuit table.

Each additional generator and each additional transmission line placed in service increases somewhat the short-circuit current through each relay on the system. It is, therefore, necessary, after even minor changes, to calculate the effect of the change upon each individual relay throughout the system.

PERMIT REDUCING DUTY ON BREAKERS

Not only has the short-circuit table been invaluable in relay setting, but it has been equally useful in determining the duty upon oil circuit breakers. Some of our older stations are equipped with earlier types of these breakers whose rupturing capacity is now greatly below the maximum duty that might be imposed upon them. By means of the table we have been able to determine experimentally relay sequences that greatly decrease the amount of energy to be handled by these circuit breakers and have, therefore, postponed, if not prevented, the necessity for replacing them.

For instance, referring to Fig. 3, showing the general scheme of connections of the principal 66,000-volt lines, it was found that the general installation of balanced power relays on these lines would reduce the energy to be handled by the circuit breakers. Thus the double duplicate line extending from No. 2 station to the Millbury substation has been equipped with balanced power relays at No. 2 station, Leverett, Ware and Millbury substations (all of which may be a source of power). If a short circuit occurs just outside the Millbury substation, the total amount of energy flowing into the short circuit will be between 500,000 kva. and 700,000 kva., which is in excess of the rupturing

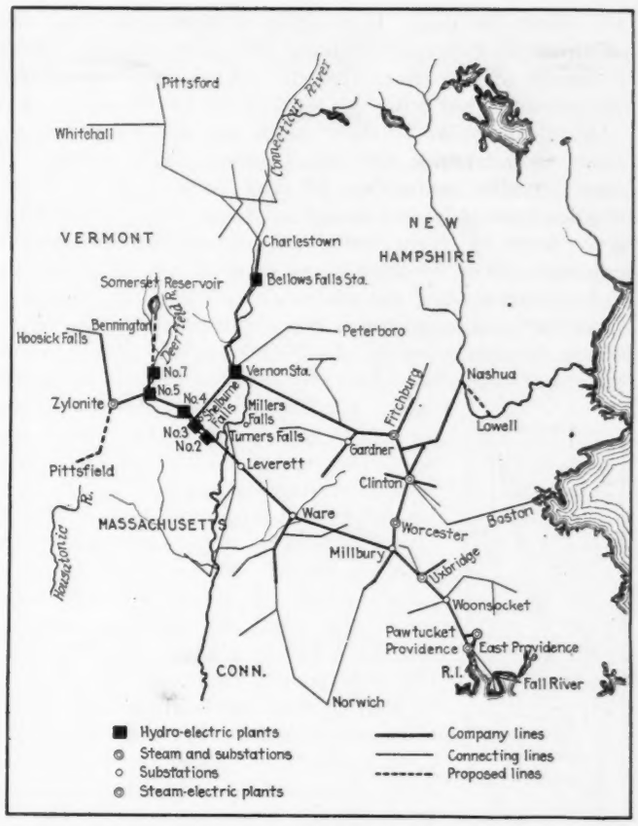


FIG. 4—SYSTEM OF NEW ENGLAND POWER COMPANY, ON WHICH CALCULATING BOARD IS USED WITH GREAT SATISFACTION

capacity of the Millbury circuit breakers. However, with balanced power relays installed, there is no tendency initially for any circuit breakers to trip other than those at Ware and Millbury. The circuit breaker at Millbury perhaps opens first, but the short circuit, though reduced in value, is not yet interrupted. The circuit breaker at Ware next operates, further reducing the short circuit, and after the Leverett circuit breaker opens the relay at No. 2 station gets its first tendency to operate. It, of course, operates, tripping the last circuit breaker on the bad line, which ruptures the short circuit, but the short circuit is now much lower than it was originally on account of the introduction of the reactance of the line between No. 2 station and Millbury by the selective operation of breakers up

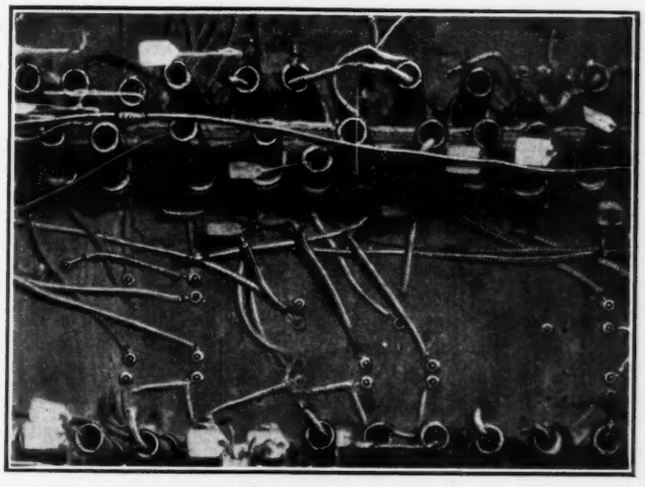


FIG. 5—METHOD OF MOUNTING RESISTORS WHICH TAKES PLACE OF EQUIVALENT REACTANCE OF CIRCUITS

and down the line. In practice it works out that each of these four circuit breakers will open, roughly, about a fourth of the short circuit. (This value, of course, varies somewhat with the location of the short circuit.)

Studies similar to those made for relay settings are made to determine the effect upon circuit breakers of every system extension of any consequence. These studies have at least warned us of the danger points and have been of great value in determining the proper capacity circuit breaker to be used in new installations.

In short-circuit calculations we have not found it practicable to make much use of time-decrement curves. There is connected to the New England Power Company's system somewhat over 500,000 kva. in generator capacity, all of which contributes more or less to any short circuit. Since the maximum short circuit on the high-tension system is within 750,000 kva., this maximum represents a short circuit of a 500,000-kva. system through 66 per cent reactance. There is only a negligible falling off of current after any time value applicable to circuit-breaker operation during a short circuit of such high relative reactance. This statement, of course, does not hold true in regard to the generators in close proximity electrically to the short circuit, for the short circuit of these generators is one of relatively lower reactance. On the other hand, the opposite thing holds true of generators more remote electrically from the short circuit, and it is probably safe to assume that these two factors offset each other.

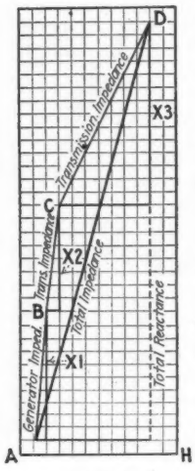


FIG. 6

Small difference between total reactance and total impedance of interconnected system.

Oscillograph tests have been made from time to time, and other data collected, to indicate accurately by an independent means the amount of energy flowing into various short circuits. These data have agreed within reason with those obtained by the calculating table.

Hydro-Electric Progress in Canada During 1922

FROM data compiled by the Dominion Water Power Branch, Department of the Interior, it is shown that during 1922 the total water-power installation in Canada grew to approximately 3,000,000 hp., of which 240,284 hp. was installed during the year. This figure does not include 190,000 hp. installed during 1922 but only brought into operation after that year had closed. Projects are now under way which will have an ultimate capacity of more than 1,000,000 horsepower.

The details of progress during 1922 are set forth in the accompanying tables. Special attention may be called to the storage development on Stave Lake and Falls Creek, British Columbia, to increase the output of existing plants; the development of the Manitoba Power Company at Great Falls, on the Winnipeg River, where the first unit of 168,000 hp. was put into service in December; the rapid increase of the installation by the Ontario Hydro-Electric Commission at Queenston; the great activity in Quebec, which includes immense developments under way on the Saguenay River and at Gres Falls on the St. Maurice River, and also the steadily maintained progress in the Maritime Provinces.

TABLE I—DEVELOPED AND AVAILABLE WATER POWER IN CANADA

Province	Turbine Installation in Horsepower: On Jan. 1, 1923	Turbine Installation in Horsepower: Installed During 1922	Available Twenty-four-Hour Power at 80 per Cent Efficiency: At Ordinary Minimum Flow, Hp.	Available Twenty-four-Hour Power at 80 per Cent Efficiency: Dependable For Six Months, Hp.
British Columbia	328,977	20,200	1,931,142	5,103,460
Alberta	33,067	.....	475,281	1,137,505
Saskatchewan	.....	.....	513,481	1,087,756
Manitoba	134,025	34,900	3,270,491	5,769,444
Ontario	1,299,230	130,300	4,950,300	6,808,190
Quebec	1,073,883	43,550	6,915,244	11,640,052
New Brunswick	42,039	11,100	50,406	120,807
Nova Scotia	47,100	234	20,751	128,264
Prince Edward Island	2,239	.....	3,000	5,270
Yukon and Northwest Territories	13,199	.....	125,220	275,250
Total for Canada	2,973,759	240,284	18,255,316	32,075,998

TABLE II—LIST OF CANADIAN HYDRO-ELECTRIC ACTIVITIES IN 1922

Plan No.	Company or Owner	Plant	Installation Made 1921 and Placed in Operation 1922	New Installations or Additions 1922, Hp.	Total Present Installation	Installations Under Construction or Actively Projected
1	British Columbia Electric Railway Co.	Stave River	.....	13,000	52,000	.....
2	East Kootenay Power Co., Ltd.	Bull River	.....	7,200	7,200	.....
3	East Kootenay Power Co., Ltd.	Elk River near Elko	.....	.....	.....	16,000
4	Manitoba Power Co.	Great Falls, Winnipeg River	.....	28,000	28,000	28,000
5	City of Winnipeg	Point du Bois, Winnipeg River	6,900	6,900	67,100	.....
6	Backus-Brooks Co.	Kenora	.....	4,800	8,200	2,600
7	Dryden Paper Co.	Wabigoon River	.....	.....	.....	1,400
8	Town of Thessalon	Little Thessalon River	.....	200	200	.....
9	Spruce Falls Co.	Kapuskasing	.....	.....	.....	2,500
10	Lower Sturgeon Power Co.	Sturgeon Falls, Mattagami River	.....	4,000	4,000	4,000
11	Great Northern Power Co.	Indian Chute, Montreal River	.....	.....	.....	6,450
12	Hydro-Electric Power Comm. of Ontario	Queenston-Chippewa, Niagara River	110,000	110,000	220,000	220,000
13	Canadian General Electric Co.	Nassau, Otonabee River	.....	1,300	2,700	.....
14	Hydro-Electric Power Comm. of Ontario	Ranney Falls, Trent River	.....	10,000	10,000	.....
15	Ottawa & Hull Power & Manufacturing Co.	Calumet Falls, Ottawa River	.....	.....	.....	30,000
16	Hull Electric Co.	Paugan Falls, Gatineau River	.....	.....	.....	100,000
17	Cie. Electrique de Rockland	Blanche River	.....	400	400	.....
18	Montreal Light, Heat & Power Cons.	Cedars Rapids, St. Lawrence River	22,600	.....	152,200	45,200
19	Laurentide Power Co.	Grand Mere, St. Maurice River	44,000	.....	164,000	.....
20	Shawinigan Water & Power Co.	Shawinigan Falls, St. Maurice River	.....	43,000	191,500	.....
21	St. Maurice Power Co.	Gres Falls, St. Maurice River	.....	.....	.....	125,000
22	Southern Canada Power Co.	Hemming Falls, St. Francis River	.....	.....	.....	30,000
23	Cie. Electrique St. Prime	St. Prime	.....	150	150	.....
24	Quebec Development Co.	Saguenay River	.....	.....	.....	350,000
25	Lower St. Lawrence Power Co.	Metis River	.....	.....	.....	3,700
26	Maine & New Brunswick Power Co.	Aroostook Falls	.....	.....	5,900	2,500
27	New Brunswick Electric Power Commission	Musquash River	.....	11,100	11,100	.....
28	Cambridge & Waterville Hydro-Electric Power Co...	Tupper Lake	.....	84	84	.....
29	Gaspereau River Light, Heat & Power Co.	Whiterock, Gaspereau River	.....	150	1,105	.....
30	Nova Scotia Power Commission	St. Margaret Bay	10,820	.....	10,820	.....
31	Nova Scotia Power Commission	Malay Falls, East River Sheet Harbour....	.....	.....	.....	3,700
		Totals	194,320	240,284	.....	971,050

Note.—In addition to the installations shown in the above table provision has been made in a number of existing plants for extensive additions as the loads increase. In addition also to the projected plants listed there are numerous other projects under study.

Nomographic Chart for Designing Illumination*

Applicable to Direct or Indirect Illumination, Using Photometric Curve of Fixture or Intensity Readings in One Plane

BY EMIL KUN
Springfield Gardens, Long Island, N. Y.

A VERY practical method for designing illumination was described in a previous issue of the ELECTRICAL WORLD (October 9, 1920, page 721) by M. M. Samuels and C. O. von Dannenberg. This method is equally and easily applicable to direct and indirect illumination, either by using the photometric curve of the lighting fixture or by obtaining foot-candle intensity readings in one plane with the aid of the foot-candle meter. It involves, however, mathematical calculations, or a graphical solution, which is to be repeated for each point to be determined, in addition to the usual tables containing values of $\cos^3\phi$ or $\cos^5\phi/H^2$ when the photometric curve is used as a starting point.

To simplify the operation and eliminate the use of all tables of coefficients, without sacrificing any of the accuracy of the method, the Nomographic chart shown herewith may be used to determine illumination without the use of any other tables of coefficients or angles. In order to explain the use of the chart the method developed by Messrs. Samuels and von Dannenberg may at first be briefly summarized. When the polar photometric curve of the fixture is used as the basis of calculation, the horizontal intensities are determined in a selected plane, which will be called "primary plane," by the well known formula:

$$I_1 = \frac{\cos^3\phi}{H_1^2}\,\text{cp.}$$

where ϕ = angle between the selected light beam and the vertical line,
H_1 = height of the focal point of fixture above the primary plane in feet,
cp. = candlepower of the lighting unit at angle from vertical,
I_1 = resulting intensity, in foot-candles.

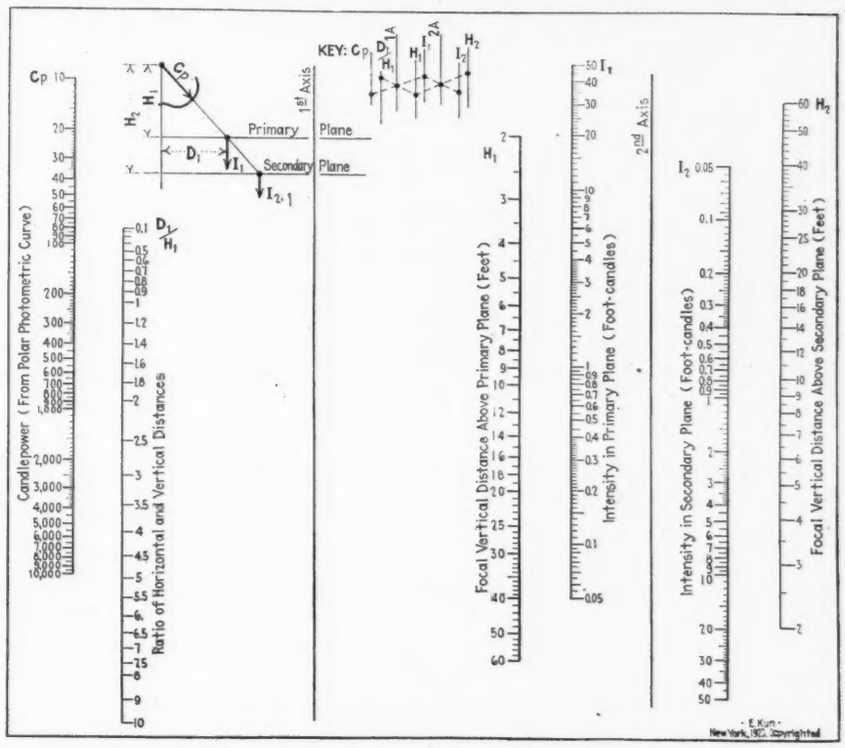
After obtaining a full-intensity curve for this primary plane, intensity curves may be developed from this curve for any other horizontal plane without referring again to the photometric curve. Let H_2 be the height of the focal point of fixture above another selected plane, which will be called "secondary plane," and which may be either above or below the primary plane. Then the horizontal intensity of illumination at the intersecting point of this secondary plane and the same light beam will be

$$I_2 = \frac{\cos^3\phi}{H_2^2}\,\text{cp.}$$

But since we are working with the same light beam, this new intensity can be directly determined from the intensity in the primary plane by dividing the above two formulas into each other, and we get:

$$I_2 = \frac{H_1^2}{H_2^2}\,I_1.$$

When using indirect or semi-indirect fixtures the best method is, as Messrs. Samuels and von Dannenberg pointed out, to obtain the intensity curve in one plane by making measurements with the foot-candle meter in a selected "primary plane," and with the fixture stem and ceiling conditions arranged in as close conformity to the conditions under which the fixtures will be used as possible and from this curve to develop intensity



CAN SOLVE ILLUMINATION PROBLEMS STARTING WITH CANDLE-POWER OR FOOT-CANDLES

curves for other planes. From this intensity curve can also be determined the "fictitious polar curve," which is the polar photometric curve of a hypothetical direct lighting unit producing an illumination equivalent to the illumination on horizontal planes produced by the indirect or semi-indirect fixture under consideration.

The nomographic chart here reproduced is a combination of the nomographic representations of the two above given formulas, namely:

$$(1)\ I_1 = \frac{\cos^3\phi}{H_1^2}\,\text{cp. and } (2)\ I_2 = \frac{H_1^2}{H_2^2}\,I_1.$$

The first formula is represented by the scales cp., D_1/H_1, H_1 and I_1, and the second by the scales H_1, I_1, I_2 and H_2. As noticed, the scales of H_1 and I_1 are common for both nomographs, and so the problem can be worked out in any direction, starting either with the candlepower of the lighting unit or the measured foot-candle intensity in the primary plane.

To obtain the intensities according to the first formula, points can be selected on the primary plane at distances D_1 from the vertical. The values D_1/H_1 for each of these points may be easily figured without even a slide rule, especially if the height H_1 for this primary plane is selected, for instance 5, 10 or 20 ft., according to the range of the unit. The index line drawn between

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Table I—Data on Output and Peak Load of Largest Generating and Distributing Systems in the United States and Canada

(This table includes all lighting, power and electric railway companies in the United States and Canada having yearly outputs in excess of 100,000,000 kw.-hr.)

Company	Rank in 1922	1922 Peak Load (Kw.)	1922 Date of Peak Load	1922 Output for Year (Kw.-Hr.)	1921 Peak Load (Kw.)	1921 Date of Peak Load	1921 Output for Year (Kw.-Hr.)	1920 Peak Load (Kw.)	1920 Date of Peak Load	1920 Output for Year (Kw.-Hr.)	1919 Peak Load (Kw.)	1919 Date of Peak Load	1919 Output for Year (Kw.-Hr.)
UNITED STATES													
Niagara Falls Power Co.	1	328,826	Nov. 23	2,252,249,000	298,120	Dec. 22	1,855,120,000	303,640	Apr. 29	2,328,326,064	275,803	Dec. 29	2,034,608,904
Commonwealth Edison Co.	2	600,000	Dec. 12	2,225,442,875	525,640	Dec. 21	1,928,271,943	478,820	Dec. 17	1,883,570,000	428,630	Dec. 15	1,628,340,000
New York Edison & United Electric Light & Power Co.	3	497,577	Dec. 20	1,659,269,781	422,721	Dec. 14	1,475,276,053	398,535	12/6 and 12/22	1,383,070,086	330,210	Nov. 25	1,104,521,883
Pacific Gas & Electric Co.	4	293,708	Nov. 10	1,608,940,735	265,925	Nov. 29	1,489,088,657	259,004	Dec. 22	1,475,678,673	244,732	.....	1,267,159,767
Southern California Edison Co.	5	239,160	Aug. 28	1,198,926,369	238,480	Dec. 13	1,224,718,196	213,450	July 12	1,079,474,091	200,020	July 23	1,021,977,519
Detroit Edison Co.	6	254,700	Dec. 7	1,105,211,100	201,500	Nov. 23	897,980,200	218,800	June 16	1,002,306,000	210,000	Dec. 5	872,583,200
Montana Power Co.	7	135,600	Aug. 10	963,662,660	116,600	Jan. 11	572,277,989	159,700	Aug. 7	1,103,620,644	133,500	June 13	865,998,552
Public Service Electric Co. of N. J.	8	249,778	Dec. 18	958,407,194	213,502	Nov. 28	821,198,975	216,452	Nov. 16	912,899,972	207,890	Dec. 16	821,355,239
Philadelphia Electric Co.	9	260,355	Dec. 14	956,910,225	213,570	Dec. 8	877,047,595	203,624	Nov. 23	910,327,693	199,247	Dec. 18	722,615,280
Southern Power Co.	10	233,000	July —	910,488,432	218,300	Feb. —	790,000,000	210,000	Nov. —	745,873,992	196,500	Dec. —	585,596,925
Duquesne Light Co.	11	208,980	Dec. 13	858,329,336	164,240	Feb. 1	702,897,985	162,000	Jan. 29	810,401,406	157,900	Dec. 22	623,000,000
Cleveland Electric Illuminating Co.	12	181,112	Dec. 14	688,149,162	141,850	Dec. 15	564,819,267	155,041	Sept. 9	682,557,097	153,878	Dec. 5	576,131,649
West Penn. Power Co.	13	137,354	Dec. 11	634,674,505	106,919	Dec. 21	516,829,636	104,618	Nov. 24	524,976,000	94,130	Dec. 22	417,911,000
Mississippi River Power Co.	14	122,300	June 14	619,837,527	117,450	Nov. 28	602,580,980	115,650	Nov. 13	644,163,000	113,450	Nov. 18	590,488,000
Alabama Power Co.	15	153,100	Dec. 18	607,133,242	115,500	Dec. 20	432,991,540	97,900	Sept. 28	488,089,061	83,100	Jan. 10	347,993,284
Buffalo General Electric Co.	16	142,000	Dec. 7	587,682,340	115,000	Nov. 14	479,862,700	108,500	Oct. 26	544,293,410	106,500	Nov. 22	508,583,680
Great Western Power Co. of California	17	105,910	Dec. 5	572,693,958	95,540	June 7	490,584,257	80,600	July 27	408,577,754	48,000	May 12	213,189,992
Consolidated Gas, Electric Light & Power Co. of Baltimore	18	138,800	Dec. 13	568,669,404	108,330	Nov. 30	415,335,614	88,990	Nov. 30	429,710,847	80,640	Dec. 5	392,201,280
North American Co. (Missouri System)	19	134,100	Nov. 27	554,551,123	116,275	Dec. 9	508,893,262	105,749	Dec. 21	471,611,047	99,498	Dec. 3	408,920,575
Niagara, Lockport & Ontario Power Co.	20	127,000	Nov. 24	552,035,090	87,000	Nov. 2	415,153,634	88,000	Jan. 6	492,466,460	.....	.....	.....
Brooklyn Edison Co., Inc.	21	164,495	Dec. 7	516,987,870	137,800	Dec. 6	438,887,775	116,500	Nov. 30	382,963,027	105,400	Jan. 15	327,084,075
Pennsylvania Power & Light Co.	22	106,987	Nov. 14	495,344,612	84,203	Sept. 27	442,507,974	87,685	Sept. —	411,639,501	81,435	Nov. —	342,071,900
Puget Sound Power & Light Co.	23	105,600	Dec. 4	474,042,886	99,800	Dec. 1	419,197,581	95,725	Dec. 3	472,765,800	93,900	Dec. 18	452,209,000
New England Power Co.	24	125,460	Dec. 14	469,993,180	112,200	Nov. 9	405,979,457	103,450	Jan. 6	430,918,000	93,860	Dec. 9	357,303,224
Consumers' Power Co.	25	116,130	Dec. 4	461,840,561	95,410	Dec. 12	397,815,027	106,924	May 19	476,095,098	108,847	Nov. 28	456,230,164
North American Co. (Wisconsin System)	26	134,482	Dec. 19	458,405,215	98,887	Nov. 22	375,354,892	90,347	Jan. 6	398,619,744	97,912	Dec. 4	331,874,192
San Joaquin Light & Power Corp.	27	67,885	Aug. 4	451,390,040	61,700	June 27	396,174,690	47,180	Aug. 28	299,536,000	.....	.....	.....
Edison Electric Illuminating Co. of Boston	28	133,594	Dec. 14	439,448,099	128,200	Dec. 15	375,025,955	105,090	Dec. 9	395,076,738	103,136	Dec. 8	328,798,850
Utah Power & Light Co.	29	87,158	Dec. 19	428,962,903	75,661	Jan. 8	362,908,000	85,404	Nov. —	519,854,000	79,780	Jan. 14	461,531,633
Minneapolis General Electric Co.	30	101,919	Dec. 7	425,916,891	83,590	Dec. 15	373,378,515	78,010	Oct. 26	359,476,651	72,745	Oct. 24	332,264,401
Washington Water Power Co.	31	89,278	Dec. 12	407,657,100	70,110	Nov. 23	374,378,300	63,955	Jan. 21	351,087,900	63,220	Dec. 3	241,761,350
Pennsylvania Water & Power Co.	32	83,000	June 10	373,341,800	83,000	Nov. —	419,987,000	85,000	Very frequent	494,624,400	87,000	Nov. —	512,138,100
Union Gas & Electric Co.	33	100,000	Dec. 13	366,071,350	75,000	12/14 and 12/23	281,537,273	65,050	Dec. 21	234,634,375	.....	.....	.....
Public Service Co. of Northern Illinois	34	82,737	Dec. 19	362,220,201	80,563	Dec. 30	415,940,095	.....	.....	.....	.....	.....	.....
Tennessee Electric Power Co.	35	82,700	Dec. 11	353,320,559	69,100	May 16	342,948,926	74,800	Apr. 30-June 4	428,649,835	82,300	Feb. 14	422,272,590
Portland Railway, Light & Power Co.	36	71,800	Dec. 28	324,116,190	64,800	Dec. 20	298,514,571	62,600	Dec. 6	292,318,971	56,300	Dec. 22	271,600,300
Los Angeles Bureau of Power and Light	37	75,275	Dec. 15	318,502,702	51,900	Dec. 21	300,353,806	46,500	Dec. 29	169,489,210	24,650	Apr. 12	134,893,270
Georgia Railway & Power Co.	38	80,000	Nov. 15	317,068,699	72,000	11/3 and 11/28	282,084,977	76,000	Apr. 9	293,721,290	71,200	Dec. 18	262,834,541
Ohio Public Service Co.	39	80,080	Nov. —	316,838,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Adirondack Power & Light Corp.	40	81,100	Dec. 14	304,997,551	61,500	Dec. 21	243,370,354	60,700	Dec. 2	277,100,000	66,000	Dec. 23	261,400,000
Narragansett Electric Lighting Co.	41	85,000	Dec. 4	297,400,000	72,000	Nov. 23	243,087,000	54,000	Jan. 5-Nov. 6	213,232,000	57,000	Dec. 23	155,678,890
Pennsylvania-Ohio Electric Co.	42	64,200	Nov. 20	276,936,464	45,300	Nov. 9	202,670,200	48,900	Nov. 3	255,537,150	.....	.....	.....
Kansas City Power & Light Co.	43	59,490	Dec. 6	253,305,000	50,531	Dec. 23	204,752,604	35,500	Dec. 23	175,939,618	.....	.....	.....
Potomac Electric Power Co.	44	70,000	Dec. 20	251,984,618	65,000	Dec. 14	238,028,571	62,000	Nov. 30	225,994,701	55,000	Dec. 17	204,008,647
Michigan Northern Power Co.	45	32,449	Nov. 3	246,175,203	35,018	Aug. 14	258,249,673	35,408	Nov. 12	257,752,195	35,794	Apr. 23	264,272,468
Northern Ohio Electric Corp.	46	43,000	Dec. —	232,684,874	42,000	Oct. 12	187,249,647	44,400	May —	247,109,963	.....	.....	.....
Virginia Railway & Power Co.	47	54,250	Dec. 18	230,293,745	47,000	Dec. 14	208,323,000	46,150	Dec. 22	208,517,000	42,800	Dec. 18	181,280,000
Toledo Edison Co.	48	58,000	Dec. 14	215,785,945	46,700	Dec. 13	179,121,428	52,400	Mar. —	207,830,610	48,220	Dec. —	199,771,799
Idaho Power Co.	49	38,323	July 25	212,237,000	35,635	Sept. 1	190,215,255	34,235	July —	184,843,000	27,090	Aug. —	154,754,000
Appalachian Power Co.	50	42,600	Dec. 4	205,447,368	35,600	Dec. 19	154,500,000	35,300	Oct. —	148,700,000	.....	.....	.....
Great Northern Power Co.	51	43,500	May 26	204,080,336	44,200	Jan. 5	204,396,870	46,000	Apr. 20	229,146,730	48,000	May 12	213,189,992
Turners Falls Power & Electric Co.	52	56,400	May 16	201,796,000	57,900	May 17	170,826,000	55,500	May 27	212,126,530	.....	.....	.....
Rochester Gas & Electric Corp.	53	53,040	Nov. 23	193,503,573	48,734	Dec. 16	185,480,692	49,400	Oct. 29	193,601,590	42,500	Dec. 2	172,892,249
New Orleans Public Service, Inc.	54	46,500	Dec. 13	188,000,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
Columbus Railway, Power & Light Co.	55	52,100	Dec. 14	187,785,967	38,440	Dec. 12	160,423,240	.....	.....	153,626,000	.....	.....	.....
Nevada-Calif. Power Co. and Southern Sierras Power Co.	56	36,200	July 14	186,671,850	45,700	6/6 and 8/8	199,452,965	32,600	July 23	175,104,808	29,200	.....	165,782,785
Texas Power & Light Co.	57	66,560	Dec. 13	183,536,613	33,620	Sept. 22	156,851,213	33,620	Oct. 14	159,939,831	29,000	Nov. 7	121,212,000
Fort Worth Power & Light Co.	58	38,500	Dec. 21	178,790,374	29,500	Oct. 15	163,286,500	.....	.....	.....	.....	.....	.....
Northwest Utilities Co. and Eastern Wisc. Electric Co.	59	43,589	Dec. —	163,902,506	31,885	Apr. —	132,788,852	.....	.....	.....	.....	.....	.....
Dayton Power & Light Co.	60	46,500	Dec. 8	159,836,687	37,500	Nov. 28	134,588,457	31,500	5/25 and 9/28	129,618,270	.....	.....	.....
Connecticut Light & Power Co.	61	45,706	Dec. 14	158,371,247	28,255	Nov. 28	101,129,915	33,392	Oct. 12	145,111,822	.....	.....	.....
Empire District Electric Co.	62	36,240	Dec. —	145,990,000	27,700	Dec. —	104,687,540	36,710	June —	148,740,220	32,030	Oct. —	130,114,100
Yadkin River Power Co.	63	37,000	Nov. 8	142,161,182	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nebraska Power Co.	64	30,200	Dec. 6	140,272,500	28,200	Oct. 28	127,758,800	25,500	Nov. 26	114,200,500	22,600	Dec. 22	97,444,900
Kansas Gas & Electric Co.	65	29,600	Dec. 7	139,167,200	25,000	Dec. —	130,479,900	.....	.....	.....	.....	.....	.....
Indianapolis Light & Heat Co.	66	38,236	Dec. 14	138,356,280	29,358	Nov. 9	108,829,278	27,240	Sept. 15	114,416,094	.....	.....	.....
Indiana & Michigan Electric Co.	67	37,450	Dec. 4	136,825,060	28,280	Dec. 16	105,593,490	27,130	Nov. 9	103,693,910	23,100	Dec. 23	84,160,770
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Indianapolis Light & Heat Co.	66	38,236	Dec. 14	136,356,280	29,358	Nov. 9	108,829,278	27,240	Sept. 15	114,416,094	23,100	Dec. 23	84,160,770
Indiana & Michigan Electric Co.	67	37,450	Dec. 4	136,825,060	28,280	Dec. 16	105,593,490	27,150	Nov. 9	103,693,910			
Hartford Electric Light Co.	68	36,400	Dec. 14	134,000,000	31,700	Nov. 14	97,754,000	32,500	Nov. 9	103,000,000			
California-Oregon Power Co.	69	27,695	Dec. 20	131,293,165	20,270	Mar. 16	133,091,607	20,335	Jan. 28	143,025,818			
United Light & Railways Co.	70	35,505	.....	129,236,964	.....	.....	.....	.....	.....	.....	.....	.....	.....
Central Maine Power Co.	71	32,500	Dec. 11, 20, 28	128,445,419	26,300	Dec. —	114,587,986	.....	.....	.....	.....	.....	.....
Central Illinois Public Service Co.	72	30,800	Oct. —	128,345,120	27,900	Nov. 30	99,815,200	28,000	Aug. 10	133,994,030	.....	.....	.....
Metropolitan Edison Co.	73	32,100	Nov. 20	127,315,007	27,900	Dec. 2	117,579,851	26,580	Jan. —	116,387,472	.....	.....	.....
Scranton Electric Co.	74	33,840	Dec. 18	126,207,493	.....	.....	.....	.....	.....	.....	.....	.....	.....
Syracuse Lighting Co.	75	33,686	Dec. 8	124,457,748	.....	.....	.....	.....	.....	.....	.....	.....	.....
Northwestern Electric Co.	76	22,700	Dec. 29	120,698,840	22,190	Dec. 12	113,913,335	20,600	Dec. 10	112,736,089	.....	.....	.....
New York & Queens Electric Light & Power Co.	77	35,300	Nov. 15	120,011,093	.....	.....	.....	.....	.....	.....	.....	.....	.....
Colorado Power Co.	78	25,777	July —	116,711,939	25,961	Mar. 9	113,805,044	29,078	Oct. 1	116,748,292	.....	.....	.....
Cleveland Municipal Electric Light System	79	25,300	Dec. 14	116,355,460	.....	.....	.....	.....	.....	.....	.....	.....	.....
New Bedford Gas & Edison Light Co.	80	47,500	Dec. 18	115,938,294	40,300	Dec. 21	89,857,700	33,700	June 17	107,599,392	.....	.....	.....
Tacoma Municipal Electric Light System	81	31,900	Dec. 5	112,546,832	28,400	Dec. 20	95,697,600	22,700	Nov. 10	120,598,174	.....	.....	.....
Blackstone Valley Gas & Electric Co.	82	38,030	Dec. 20	110,225,488	.....	.....	.....	.....	.....	.....	.....	.....	.....
Houston Light & Power Co.	83	24,200	Nov. 22	108,646,517	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cohoes Power & Light Corp.	84	28,000	Dec. 20	103,195,985	.....	.....	.....	.....	.....	.....	.....	.....	.....
Denver Gas & Electric Light Co.	85	28,800	Dec. —	102,631,000	.....	.....	.....	.....	.....	.....	.....	.....	.....
CANADA													
Hydro-Electric Power Commission of Ontario	1	460,471	Dec. 13	2,392,092,267	160,500	Dec. 19	863,124,240	192,200	Nov. 17	1,140,759,076	172,900	Jan. 14	1,031,111,695
Shawinigan Water & Power Co.	2	250,000	Dec. 19	1,383,390,773	151,000	Jan. 5	825,115,600	152,000	Dec. 15	1,061,596,054	150,000	Nov. 12	949,223,500
Ontario Power Co.	3	213,100	Jan. 30	994,000,000	165,900	Nov. 16	907,231,573	169,450	Nov. 17	900,328,757	164,415	Dec. 16	852,680,550
Montreal Light, Heat & Power Co.	4	185,550	Nov. 27	945,200,656	34,264	Nov. 23	125,124,855	.....	.....	.....	.....	.....	.....
City of Winnipeg Hydro-Electric System	5	38,048	Dec. 11	144,509,000	109,000	Nov. 28	630,468,000	109,000	Dec. 21	649,748,800	115,000	Jan. 8	546,477,616
Toronto Power Co.*	..	.....	.....	.....	27,200	Mar. 1	122,684,800	.....	.....	.....	.....	.....	.....
Western Power Co. of Canada	..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
ELECTRIC RAILWAYS													
Interborough Rapid Transit Co.	1	246,770	Jan. 24	886,223,920	242,760	Dec. 30	846,487,668	242,020	Jan. 31	816,603,610	239,940	Dec. 19	810,158,475
Chicago Surface Lines	2	.....	.....	735,246,576	.....	.....	712,683,840	.....	.....	.....	.....	.....	.....
Brooklyn Rapid Transit Co.	3	118,800	Jan. 24	413,992,125	116,000	Dec. 22	383,009,325	111,147	Jan. 15	389,784,451	111,000	Dec. 16	406,130,443
Philadelphia Rapid Transit Co.	4	110,446	Dec. 19	346,506,580	105,303	Dec. 22	333,222,786	102,210	Jan. 14	349,027,334	101,120	Dec. 18	349,542,666
Boston Elevated Railways Co.	5	78,755	Dec. 13	240,547,615	75,905	Jan. 18	223,061,330	72,295	Jan. 14	246,312,170	71,760	Mar. 23	240,429,915
Pennsylvania R.R. Co., Long Island Plant	6	72,000	Dec. 30	214,906,725	64,000	Dec. 30	201,922,210	55,200	Jan. 5	199,737,907	53,900	Dec. 19	181,017,940
New York Central Railroad Co.	7	48,470	Jan. 3	157,450,819	50,750	Dec. 23	149,275,239	46,440	Dec. 27	157,132,366	44,100	Dec. 29	140,435,406
Twin City Rapid Transit Co.	8	47,005	Dec. 14	145,675,337	44,599	Feb. 8	145,517,164	42,700	Dec. 21	139,711,248	46,612	Nov. 28	133,676,628
Chicago, Milwaukee & St. Paul Ry. Co.	9	12,000	.....	137,747,598	.....	.....	.....	.....	.....	.....	.....	.....	.....
Kansas City Railways Co.	10	40,200	Dec. 12	123,830,190	43,500	Jan. 13	129,804,772	51,740	Jan. 8	189,172,898	49,430	Oct. 27	211,707,571

* Purchased by Hydro-Electric Power Commission of Ontario on Nov. 1, 1922. Blank indicates that no report covering year was received.

the values of D_1/H_1 corresponding to the location of the point under consideration and the point on the H_1 scale representing the height of the focal point above this plane will cut the first axis in a point which projected by another index line drawn from the cp. (candlepower) scale will cut the I_1 scale at the resulting horizontal intensity.

In order to determine the intensities in the secondary plane, an index line should be drawn between the proper points on the H_1 and H_2 scales. This index line will cut the second axis line in a point which will be constant for all calculations between the two selected planes. By projecting the values on the I_1 scale through this point to the I_2 scale, the resulting intensities in the secondary plane may be directly read off. It should, however, be remembered that these corresponding intensities are not above each other on the two planes, but on the same light beam, and for this reason the location of the corresponding points should be determined by drawing up on a piece of paper two horizontal lines representing the two planes, in a suitable scale, and projecting the selected points on the primary plane to the secondary plane from the focal point of the unit.

As may be seen from the above explanation, the chart may be used in either direction. Problems of determining the proper height of the fixture or determining the necessary candlepower values for the unit can be solved almost instantly, without the use of any tables, and with an accuracy which is very close to that of methods involving calculations.

Eight Systems with Output of 1,000,000,000 Kw. in 1922

"Electrical World" Survey Indicates, Besides, that Last Year Ninety-two Companies of the United States and Canada Reported Individual Outputs Exceeding 100,000,000 Kw.-Hr.

IN LINE with its policy of keeping in intimate touch with the operations of the central generating plants of the country, the ELECTRICAL WORLD has just completed a survey of the electric generating and distributing companies of the United States and Canada having a total output in excess of a hundred million kilowatt-hours during 1922. A similar survey undertaken during past years indicated that in 1919 there were six companies distributing in excess of a billion kilowatt-hours, in 1920 nine such companies, and in 1921 only five. The present investigation indicates that eight electric light and power companies distributed over a billion kilowatt-hours last year. Of these eight systems, six were operating in the United States and two in Canada. There were also six other systems whose output was very close to the billion mark.

Table I is believed to be a complete list of the electric light and power companies and electric railway companies of the United States and Canada with an output in excess of 100,000,000 kw.-hr. during 1922, giving also their total output and the amount and date of their peak load. Table II lists these companies by sections of the country and gives the proportion of the output which was generated, the proportion purchased and also the distribution of the energy.

Ninety-two electric light and power systems and ten electric railway systems reported an output in excess

Table II—1922 Detailed Output and Distribution Data for North American Systems

Section and System	Generated and Purchased Output, in Kilowatt-Hours			Distribution of Energy, in Kilowatt-Hours					
	Total Output	Generated	Purchased	Light	Power	Light and Power	Electric Railways	Other Public Utilities	Inter-Company Business and Line Losses, Etc.
New England States									
New England Power Co.	469,993,180	255,641,165	214,352,015	None	170,067,397	170,067,397	37,556,495	192,580,447	69,788,841
Edison Electric Ill. Co. of Boston	439,448,099	419,816,900	19,631,199			281,718,732	9,417,886	46,898,768	101,412,713
Narragansett Electric Light Co.	297,400,000	277,900,000	19,500,000	30,300,000	81,200,000	111,500,000	422,000	None	185,478,000
Turners Falls Pwr. & Elec. Co.	201,796,000	174,550,000	27,246,000	None	67,055,000	67,055,000	27,488,000	84,306,000	22,947,000
Connecticut Light & Power Co.	158,371,247	121,617,882	36,753,365	22,029,026	68,781,996	90,811,022	19,838,695	12,708,874	35,012,656
Hartford Electric Light Co.	134,000,000	127,000,000	7,000,000	30,000,000	49,000,000	79,000,000	None	40,000,000	15,000,000
Central Maine Power Co.	128,445,419	115,338,118	13,107,301	20,154,415	59,936,489	80,090,904	12,435,105	None	35,919,410
New Bedford G. & Edison Lt. Co.	115,938,294	115,938,294	None	8,704,215	81,464,693	90,168,908	13,269,200	None	12,500,186
Blackstone Valley Gas & Elec. Co.	(a) 110,225,488	63,599,042	46,626,446			77,736,527	4,227,680	9,829,860	18,431,421
Middle Atlantic States									
Niagara Falls Power Co.	2,252,249,000	2,252,249,000	None	None	1,228,918,000	1,228,918,000	7,116,000	897,219,000	118,996,000
N. Y. Edison Co. and United Electric Light & Power Co.	1,659,269,781	1,659,249,981	19,800			931,933,806	221,511,516	12,000,553	493,823,906
Public Service Elec. Co.	958,407,194	939,413,040	18,994,154	200,415,938	332,074,985	532,490,923	213,317,893	533,840	212,064,538
Philadelphia Elec. Co.	956,910,225	956,910,225	None	210,951,724	331,171,316	542,123,040	266,271,402	16,347,500	132,168,283
Duquesne Light Co.	858,329,336	845,228,690	13,100,646	177,738,226	291,833,319	469,571,545	225,288,009	32,619,316	130,850,466
West Penn Power Co.	(a) 634,674,505	631,767,550	2,906,955	53,071,715	403,659,376	456,731,091	53,542,747	9,446,691	114,953,976
Buffalo General Elec. Co.	587,682,340	95,560,300	492,122,040	118,552,856	319,652,173	438,205,029	62,429,500	None	87,047,811
Niagara, Lockport & Ontario Power Co.	552,035,090	124,827,196	427,207,894			107,099,056	84,965,319	292,812,827	67,157,888
Brooklyn Edison Co.	516,987,870	510,009,000	6,978,870	167,863,916	205,154,534	373,018,450	1,809,300	6,404,550	135,755,571
Pennsylvania Power & Light Co.	495,344,612	407,274,915	88,069,697	46,118,740	307,639,612	353,758,352	None	79,502,206	62,084,054
Pennsylvania Water & Power Co.	373,341,800	373,341,800	None	None	None	None	None	334,335,100	39,006,700
Adirondack Power & Light Corp.	304,997,551	251,336,281	53,661,270	25,663,429	101,939,578	127,603,007	89,654,099	27,884,690	59,855,755
Rochester Gas & Elec. Corp.	193,503,573	177,058,214	33,610,202	73,695,740	49,491,040	123,186,780	40,220,220	7,206,730	22,889,843
Metropolitan Edison Co.	127,315,007	117,037,540	10,277,467	12,975,564	52,040,760	65,016,324	24,116,246	18,273,839	19,908,598
Scranton Elec. Co.	126,207,493	118,839,497	7,367,996						
Syracuse Lighting Co.	124,457,748	440,486	124,017,262	22,390,673	84,142,891	106,533,564	2,197,983	3,169,120	12,557,081
N. Y. & Queens Electric Light & Power Co.	120,011,093	2,828,720	117,182,373	43,439,703	54,349,625	97,789,328	2,829,850	None	19,391,915
Cohoes Power & Light Corp.	103,195,985	102,179,570	1,016,415	1,962,202	44,941,031	46,903,233	None	46,872,893	9,419,859
South Atlantic States									
Southern Power Co.	910,488,432	828,689,140	81,799,292			582,257,032	12,953,342	137,349,945	177,928,113
Consolidated Gas, Electric Light & Power Co. of Baltimore	568,669,404	320,327,104	248,342,300	(b) 96,209,311	(c) 262,041,626	358,250,937	143,627,887	None	66,790,580
Georgia Railway & Power Co.	317,068,699	269,874,299	47,194,400	37,954,723	115,181,946	153,136,669	55,320,357	51,268,426	57,343,247
Potomac Electric Power Co.	251,984,618	251,979,077	5,541	74,903,160	41,886,773	116,789,933	89,798,929	2,500,609	42,895,147
Virginia Railway & Power Co.	230,293,745	214,051,055	16,242,690			140,847,022	51,099,763	None	38,346,960
Appalachian Power Co.	205,447,368	203,657,968	1,789,400	4,710,356	163,616,676	168,327,032	None	485,230	36,635,106
Yadkin River Power Co.	142,161,182	77,217,950	64,943,232	1,398,399	25,307,754	26,706,153	None	91,376,883	24,078,146
East North Central States									
Commonwealth Edison Co.	2,225,442,875	2,207,635,533	17,807,342	(d) 598,229,859	555,318,807	1,153,548,666	735,246,576	73,884,430	262,763,203
Detroit Edison Co.	1,105,211,100	1,105,210,100	1,000	221,628,400	521,055,500	742,683,900	123,577,400	30,152,200	208,797,600
Cleveland Electric Ill. Co.	688,149,162	688,149,162	None	(e) 119,773,212	329,266,124	449,039,336	138,211,097	5,474,950	95,423,779
Consumers' Power Co.	461,840,561	442,423,193	19,417,368	78,686,402	201,577,987	280,264,389	64,596,758	1,288,524	115,690,890
North American Co. (Wisc. Sys.)	458,405,215	395,963,393	62,441,822	91,876,579	184,861,240	276,737,819	90,808,258	20,763,861	70,095,277
Union Gas & Electric Co.	366,071,350	366,071,350	None	(f) 60,317,902	142,154,706	202,472,608	47,451,884	44,159,089	71,987,769
Public Service Co. of No. Illinois	(g) 362,220,201	366,843,534	70,940,377	(h) 52,972,338	(i) 152,690,132	205,662,470	43,276,362	42,195,650	71,085,719
Ohio Public Service Co.	316,838,000	264,081,000	52,757,000	24,890,000	238,362,000	263,252,000	None	(j) 22,711,000	30,875,000
Pennsylvania-Ohio Electric Co.	276,936,464	275,519,815	1,416,649	37,693,199	155,807,457	193,500,656	36,921,101	13,843,768	32,670,939
Michigan Northern Power Co.	246,175,203	246,175,203	None	3,251	245,190,209	245,193,460	626,100	None	355,643
Northern Ohio Electric Corp.	232,684,874	138,634,600	94,050,274	33,256,445	(k) 89,369,939	122,626,384	48,920,798	(l) 12,770,802	48,366,890
Toledo Edison Co.	215,785,945	215,785,945	None	44,680,870	84,772,380	129,453,250	51,457,000	1,448,280	33,427,415
Columbus Ry. Power & Light Co.	187,785,967	187,785,967	None	14,462,439	99,507,397	113,969,836	694,977	None	73,121,154
Northwest Utilities Co.	163,902,506	134,973,837	28,928,669	6,131,134	11,371,764	17,502,898	None	125,950,004	20,449,604
Dayton Power & Light Co.	159,836,687	159,836,687	None	28,462,525	73,809,845	102,272,370	26,249,617	4,216,430	27,098,270
Indianapolis Light & Heat Co.	138,356,280	138,356,280	None	14,818,834	83,929,740	98,748,574	None	9,816,510	29,791,196
Indiana & Michigan Electric Co.	136,825,060	136,825,060	None	( ) 17,035,919	56,865,944	73,901,863	12,145,652	26,714,346	24,063,199
United Light & Railways Co.	129,236,964	94,526,209	34,710,755	28,479,857	52,908,151	81,388,008	25,068,051	4,402,395	18,378,510
Central Illinois Public Service Co.	128,345,120	79,068,880	49,276,240	21,974,124	50,343,060	72,317,184	None	12,597,950	43,429,986
Cleveland Munic. Elec. Lt. Sys.	116,355,460	116,355,460	None						
West North Central States									
Mississippi River Power Co.	619,837,527	612,450,500	7,387,027	None	124,157,118	124,157,118	None	435,590,258	60,090,151
North American Co. (Missouri System)	554,551,123	263,351,244	291,199,879	120,267,711	181,798,524	302,066,235	3,297,678	179,181,811	70,005,399
Minneapolis General Electric Co.	425,916,891	376,763,221	49,153,670	97,134,650	175,653,983	272,788,633	1,098,310	72,392,699	79,637,249
Kansas City Power & Light Co.	253,305,000	252,874,000	431,000	71,903,000	121,076,000	192,979,000	None	13,248,000	47,078,000
Great Northern Power Co.	204,080,336	184,894,300	19,186,036	45,141,385	101,818,363	146,959,748	20,019,551	(o) None	37,101,037
Empire District Electric Co.	145,990,000	134,924,000	11,066,000	8,363,000	76,428,000	84,791,000	11,330,000	15,396,000	34,473,000
Nebraska Power Co.	140,272,500	140,272,500	None	41,342,465	58,816,176	100,158,641	None	20,320,717	19,793,142
Kansas Gas & Electric Co.	139,167,200	123,771,400	15,395,800	24,473,528	78,135,016	102,608,543	None	14,019,185	22,539,472
East South Central States									
Alabama Power Co.	607,133,242	(p) 601,961,130	5,172,112	8,844,888	291,586,183	300,431,071	(q)	211,483,168	95,219,003
Tennessee Electric Power Co.	353,320,559	347,821,459	5,499,100	10,939,511	122,983,081	133,922,592	12,076,167	158,422,582	48,899,218
West South Central States									
New Orleans Public Service, Inc.	188,000,000	188,000,000	None	34,000,000	45,000,000	79,000,000	42,000,000	28,000,000	39,000,000
Texas Power & Light Co.	183,536,613	60,517,540	123,019,073	19,565,765	68,270,720	87,836,485	None	63,032,708	32,667,420
Fort Worth Power & Light Co.	178,790,374	178,710,000	80,374	15,035,704	34,766,421	49,802,125	None	119,656,805	9,331,444
Houston Light & Power Co.	108,646,517	108,640,561	5,956	22,428,869	67,466,326	89,895,195	None	775,320	17,976,002
Mountain States									
Montana Power Co.	963,662,660	963,662,660	None	29,283,805	672,389,122	696,672,927	115,296,757	15,789,108	135,903,868
Utah Power & Light Co.	428,962,903	428,306,173	656,730	43,878,007	250,743,342	294,621,349	None	57,070,291	77,271,263
Idaho Power Co.	212,237,000	203,489,000	8,748,000	75,271,393	76,102,857	151,374,250	(q)	10,065,683	50,797,063
Colorado Power Co.	116,711,939	116,526,059	185,880	4,040,006	23,226,399	27,266,405	6,106,200	67,504,147	15,835,187
Denver Gas & Electric Co.	102,631,000	47,667,000	54,964,000	50,981,000	30,944,000	81,925,000	None	None	20,706,000
Pacific States									
Pacific Gas & Electric Co.	1,608,940,735	1,372,486,323	236,454,412	159,493,472	537,041,748	696,535,220	246,868,669	154,719,110	510,817,736
Southern California Edison Co.	1,198,926,369	1,131,422,133	67,504,236	71,484,750	388,812,361	460,297,111	283,411,584	157,324,993	297,892,681
Great Western Power Co.	572,693,958	555,143,180	17,550,778	55,938,977	218,297,138	274,236,115	28,474,234	107,089,605	162,894,004
Puget Sound Power & Light Co.	474,042,886	415,167,721	58,875,165			371,445,234	34,427,029	None	68,170,623
San Joaquin Light & Power Co.	451,390,040	451,212,600	177,440	35,284,975	227,181,530	262,466,405	4,360,228	103,556,901	81,006,406
Washington Water Power Co.	407,657,100	407,657,100	None			201,420,831	52,413,544	84,755,024	69,067,701
Portland Ry. Light & Power Co.	324,116,790	323,645,100	471,690	43,623,410	114,139,458	157,762,868	84,369,572	4,207,195	77,777,155
Los Angeles Bureau of Pwr. & Lt.	318,502,702	247,747,650	70,755,052	70,550,163	119,769,081	190,319,244	None	65,575,844	61,122,021
Southern Sierras Power Co., & Nevada-California Power Co.	186,671,850	186,259,800	412,050	6,315,296	116,333,596	122,648,892	None	5,956,605	58,066,353

Table II (Continued)

Section and System	Generated and Purchased Output in Kilowatt-Hours			Distribution of Energy, in Kilowatt-Hours					
	Total Output	Generated	Purchased	Light	Power	Light and Power	Electric Railways	Other Public Utilities	Inter-Company Business and Line Losses, Etc.
California Oregon Power Co.	131,293,165	130,124,154	1,169,011	10,631,861	29,290,664	39,922,525	None	55,289,773	36,080,867
Northwestern Electric Co.	120,698,840	118,276,300	2,422,540	16,761,409	75,306,475	92,067,884	None	955,290	27,675,666
Tacoma Municipal Elec. Lt. Sys.	112,546,832	104,369,812	8,177,020	83,535,930	53,142,551	86,678,481	1,189,171	701,168	23,978,012
Canada									
Hydro-Elec. Pwr. Comm. of Ont.	2,392,092,267	1,986,469,720	405,622,547						
Shawinigan Water & Power Co.	1,383,390,773	1,056,440,673	326,950,100			986,416,767	(r)	273,881,292	123,092,714
Ontario Power Co.	994,000,000	732,040,000	261,960,000	None	308,170,000	308,170,000	None	685,830,000	(t)
Montreal Light, Heat & Power Co.	945,200,656	713,400,020	231,800,636			900,000,000	45,200,656	None	(t)
Winnipeg Municipal Hydro-Electric System	144,509,000	144,509,000	None	77,670,248	36,295,883	113,966,131	None	3,512,000	26,972,769
Electric Railway Cos.									
Interborough Rapid Transit Co.	886,223,920	885,919,380	304,540	None	325,486	325,486	788,191,920	None	97,706,514
Chicago Surface Lines	735,246,576	None	735,246,576						
Brooklyn Rapid Transit Co.	413,992,125	413,992,125	None	None	None	None		None	
Philadelphia Rapid Transit Co.	346,506,580	116,686,993	229,819,587	None	None	None		None	
Boston Elevated Railways Co.	240,547,615	240,547,615							
Pennsylvania Railroad Co.	214,906,725	212,399,800	2,506,925	3,435,530	2,012,828	5,448,358	128,726,650	38,720	80,692,997
New York Central Railroad Co.	157,450,819	157,450,819	None					None	
Twin City Rapid Transit Co.	145,675,337	97,483,549	48,191,788	None	None	None			
Chicago, Milwaukee & St. Paul Railway Co.	137,747,598	None	137,747,598	None	None	None		None	
Kansas City Railway Co.	123,830,190	123,830,190	None	None	None	None		505,671	

(a) Includes also certain affiliated companies known as the "West Penn System." (b) Reported as "Commercial and residential customers." (c) Reported as "industrial customers." (d) Includes power for electric appliances, which is estimated to be 42,509,000 kw.-hr. (e) Includes 8,327,726 kw.-hr. for municipal street lighting. (f) Includes 10,635,307 kw.-hr. for municipal street lighting. (g) Does not include 75,563,710 kw.-hr. generated at Blue Island station and prorated to the Commonwealth Edison Company. (h) Includes 174,475 kw.-hr. for lighting supplied by company in Commonwealth Edison territory. (i) Includes 16,127 kw.-hr. for power supplied by company in Commonwealth Edison territory. (j) Includes intercompany sales. (k) Includes combined light and power. (l) Includes energy sold to municipalities. (m) Includes 1,925,377 kw.-hr. for municipal lighting and 212,425 kw.-hr. for heating and cooking. (n) Includes 9,078,044 kw.-hr. distribution line losses, 13,696,832 transmission line losses, and 1,288,323 kw.-hr. used by company. (o) Included under "lighting." (p) 6,928,030 kw.-hr. generated at plant of Birmingham Light & Power Co., under joint operation. (q) Included under "Other Public Utilities." (r) Included under "Light and Power." (s) Includes Pawtucket and Woonsocket divisions. (t) Output metered at generating station.

of 100,000,000 kw.-hr. in 1922. The total output of these electric light and power companies was in excess of 41,000,000,000 kw.-hr. Deducting the output of the Canadian systems gives 35,577,290,423 kw.-hr. as the total output of the electric light and power companies in the United States having an annual output in excess of 100,000,000 kw.-hr. This would indicate that about 70 per cent of the total output of the central generating and distributing companies of this country is distributed by ninety-two systems.

The Niagara Falls Power Company leads the country, reporting a total output of 2,252,249,000 kw.-hr., all of which was generated at its own plants. The Commonwealth Edison Company of Chicago, which took the lead in 1921, is a close second, reporting as its output 2,225,442,875 kw.-hr., of which 99.25 per cent was generated in its own plants. The New York Edison Company and the United Electric Light & Power Company, combined, were third, displacing the Pacific Gas & Electric Company. The Hydro-Electric Power Commission of Ontario, however, reported the largest output of all systems in the world, with 2,392,092,267 kw.-hr.

The largest peak load was reported by the Commonwealth Edison Company of Chicago, with 600,000 kw. The New York Edison Company and the United Electric Light & Power Company combined had the second largest peak load, with 497,577 kw.

The larger electric generating and distributing companies are fairly well scattered over the country, although, of course, most numerous in the industrial sections. It is rather surprising that during the past two years only one system in the Mountain and Pacific States has entered the 100,000,000-kw.-hr. class as against thirteen Eastern companies. Also the intensely industrial New England section reports no company with an output in excess of 500,000,000 kw.-hr.

Unusually High Operations During January

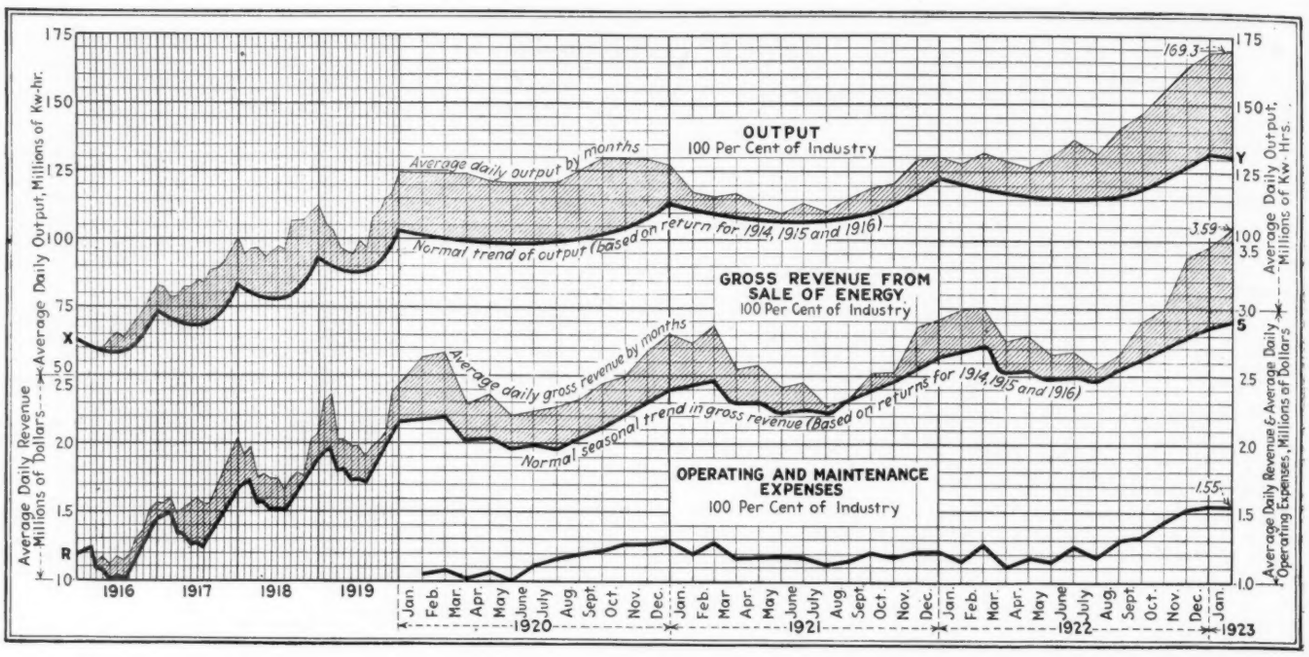
Output for the First Month of the Year Totaled 5,245,000,000 Kw.-Hr., an Increase of 28.5 per Cent for the Twelve-Month Period

FOUR new records were hung up by the electric light and power industry during January. Reports for the month received by the ELECTRICAL WORLD from electric generating and distributing companies representing 78 per cent of the installed generator rating of the country indicate that the average daily output was 169,290,000 kw.-hr. This exceeded the previous record, made during December, by 1,232,000 kw.-hr. In addition, the total output for the month of January was 5,245,000,000 kw.-hr., which exceeded the former high monthly figure, set during December,

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1922 Thousands	1921 Thousands	Per Cent Increase
Nov...	81	3,964,299	3,208,870	23.6	75	$75,909	$65,203	16.4
Dec...	77	4,011,609	3,200,661	25.2	71	76,360	65,613	16.4
		1923	1922			1923	1922	
Jan...	78	4,093,452	3,185,282	28.5	72	80,193	67,592	18.7

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting) 1922 Thousands of Dollars	1921 Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1922	Steam Plants 1921	Hydro Plants 1922	Hydro Plants 1921	Combined Systems of Steam and Hydro 1922	Combined Systems of Steam and Hydro 1921
Nov...	62	28,308	26,071	8.6	50.4	50.2	24.3	25.0	46.0	45.3
Dec..	59	28,784	23,687	21.5	49.3	48.3	29.7	27.7	48.8	46.2
		1923	1922		1923	1922	1923	1922	1923	1922
Jan...	59	28,486	23,050	23.6	47.3	45.3	23.8	23.4	45.3	43.1



by 45,000,000 kw.-hr. and the output reported for January, 1922, by 28.5 per cent. The second set of record figures reported by the central stations for the month of January is to be found in the revenue received from the sale of energy. The average daily revenue from the sale of energy during January was $3,590,000, which exceeded the previous record, made during December, by $123,000. In addition, the total gross revenue for the month of January totaled $111,300,000, which exceeded the previous record, made during December, by $3,800,000.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to the gross revenue from the sale of energy, shows that the industry is not in quite so good a position financially as it was this time last year. The operating ratio reported for January by companies having steam plants only, taken in the aggregate, was 47.3 per cent against 45.3 per cent for January of last year. It is encouraging to notice that the operating ratio has decreased from 56.6 per cent in August, or by about 9.3 per cent. Such a decrease in the operating ratio between winter and summer months is to be expected, however, on account of the relatively higher percentage of low-revenue industrial energy sold during the summer months. If the normal trend of past years is followed, the operating ratio should commence to increase with February on account of the decreasing high-revenue lighting load, but if the price of coal decreases during the spring months, it may be that the operating ratio will decrease to a lower point than that reached during January, nothwithstanding the decreased lighting requirements.

Study of Street-Lighting Practice

THE study of street-lighting service undertaken by the Bureau of Standards several years ago but suspended in war time has been actively resumed. This study will cover street lighting in all its phases—gas, electric and other special types. The problems of design of street-lighting systems from the illuminating standpoint, the distribution of gas and electricity for street lighting, methods of operation and maintenance and the technical and engineering features of contracts for street-lighting service will be included. The results of this and other studies on the subject will be presented, if possible, in the form of a publication.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States			
	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase
KW.-HR. OUTPUT:																				
Nov.	80	312,949	248,370	25.8	78	1,438,270	1,160,878	23.9	81	1,318,588	1,073,114	23.6	64	212,739	159,917	33.1	97	681,753	566,591	20.3
Dec.	82	338,419	255,657	32.4	76	1,507,025	1,213,409	24.2	74	1,251,239	997,922	25.4	62	210,897	165,922	27.2	93	704,029	567,751	24.0
1923	[6]	1923	1922			1923	1922			1923	1922			1923	1922			1923	1922	
Jan.	[8]	327,292	252,245	29.8	76	1,549,604	1,196,898	29.4	73	1,304,444	1,008,032	29.6	63	206,408	155,148	33.0	94	705,704	572,959	23.2
REVENUE:																				
Nov.	80	[$7,744	$6,875	12.6	73	$28,579	$24,363	17.3	69	$23,659	$20,037	18.2	62	$5,022	$4,330	16.0	96	$10,905	$9,598	13.6
Dec.	82	8,481	7,104	19.4	71	29,436	25,763	14.3	62	22,163	18,518	19.6	61	5,129	4,378	17.2	93	11,151	9,850	13.2
1923		1923	1922			1923	1922			1923	1922			1923	1922			1923	1922	
Jan.	86	8,624	7,275	18.5	71	31,637	26,785	18.1	62	23,453	18,835	24.5	62	5,173	4,478	15.5	94	11,306	10,219	10.6
OPERATING EXPENSES:																				
Nov.	52	$2,545	$2,161	17.7	54	$8,942	$7,806	14.6	57	$10,540	$8,468	24.4	62	$2,597	$2,178	19.3	94	$3,684	$3,537	4.1
Dec.	51	2,796	2,016	36.8	53	9,431	8,141	15.8	51	9,559	7,368	29.7	61	2,624	2,216	18.5	92	4,374	3,946	10.8
1923		1923	1922			1923	1922			1923	1922			1923	1922			1923	1922	
Jan.	52	2,432	2,033	19.7	55	9,525	8,013	18.9	51	9,737	7,359	32.3	62	2,550	2,052	24.2	93	4,242	3,593	18.0

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Rating of Electrical Apparatus

To the Editors of the ELECTRICAL WORLD:

In answer to your request for a commentary on the new British standard specifications, referred to in your issue of March 24, I would say that, in my opinion, they are a step forward in giving proper recognition to the requirements of the user. These requirements I shall attempt to cover in their essentials in the following notes.

The fundamental reason that eventually will make the double rating of electrical apparatus the accepted engineering and commercial standard is one which in the ultimate analysis directly affects only the user.*

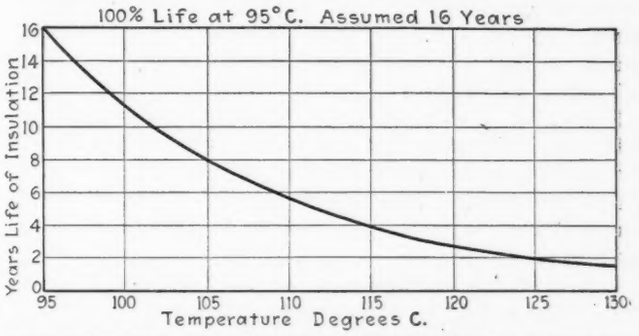
The maximum power capacity of an electrical machine is not a definite quantity representable by a single value, such as is the cubic-feet flow of water per second in a water-power plant. As a matter of fact, the power of most electrical apparatus may vary widely. It is therefore obvious that to make an intelligent application of the apparatus the user must know the limits of power which he may expect to obtain from a machine when unusual or unforeseen conditions are encountered. To illustrate with a few simple cases, the power engineer who is equipping a machine for sawing 2-in. planks will inform his client that if in an emergency he must saw a 3-in. plank the motor will have sufficient power to do his work safely. A distribution engineer planning a customer's service connection will provide not only transformers and cable connections capable of carrying continuously the estimated maximum load of the building, but also a liberal margin to meet unexpected larger demands, or even to carry the customer's load with a portion of the transformers and cable connections temporarily disconnected on account of failures of apparatus or other emergencies affecting the distributing system. The designer of a substation will similarly have to reckon that if he loses one of the transforming sets those remaining must have the capacity needed to carry the maximum load even if they should, for the time being, operate in excess of their normal load. These conditions are not the exception; they are the general rule for the great majority of power applications, since there are relatively very few applications where the maximum possible demand of power is strictly limited to a definite amount, as would be the case with a water-pumping set where the load was limited by both the speed and the head of water. If there should be no elasticity whatever beyond the rated capacity of the electrical apparatus in a substation, let us say, to meet emergencies or limited demands of short duration, it would in regular operation be equivalent to actually reducing the substation's capacity. It is evident that the operators would refrain from approaching the loading of the apparatus to the full rated capacity, as they would then have no safety margin left at all, and to provide for such margin on which they might be compelled to fall back at any time, they would actually reduce the maximum load which they would allow the station to carry to a certain amount below the rated capacity, thus providing at a sacrifice of operating capacity the necessary flexibility. There is, therefore, no question that the user must recognize those conditions of service which occasionally demand an increase in power over that nominally required. On this vital point rests the difficulty of the single rating.

If we choose to give a piece of apparatus only one rating, we are confronted with two alternatives:

(1) The rating may be conservative, but we then fail to inform the user of the extra capacity available for the occasional heavier load demands that are mentioned above.

(2) The rating we choose may approach the maximum capacity of which the apparatus is capable, but then the user, to provide the margin for the occasional heavier loads, must "derate" the apparatus; that is, he must select equipment of larger size in order to secure the margin of capacity required for his occasional heavier load demands.

Many will perhaps say that all apparatus will carry considerable overloads without breaking down, and that engineers of course figure in the back of their heads on such margins of capacity in motors, cables, transformers, etc. On the other hand, it seems that such haphazard procedure in figuring a margin of capacity to meet unavoidable temporary overloads is apt to be uneconomical and to lead to unsatisfactory or wasteful results.



CHARACTERISTIC LIFE OF ELECTRICAL INSULATION AS AFFECTED BY OPERATING TEMPERATURE

This curve indicates graphically that, other things being equal, a machine operating at 105 deg. C. will have a life only 50 per cent of that of a similar machine operating at 95 deg. C. From the curve we can calculate that if we operate a machine 90 per cent of the time at 95 deg. C. and the remaining 10 per cent of the time at 115 deg. C., the life of the machine will be 77 per cent of the virtual life at 95 deg. C. for 100 per cent of the time, and similarly that this 77 per cent of the virtual life would be more than 50 per cent longer than the life of machines operating 105 deg. C. for 100 per cent of the time.

The double rating undoubtedly gives the user a more satisfactory means of selecting his electrical apparatus to meet most economically both the normal and abnormal conditions of service.

The double rating was used the world over up to a few years ago. In this country it was largely abandoned during the period of the war, perhaps without any bestowal of the careful consideration which the importance of the change would have justified. Abroad somewhat similar steps were taken, but at least one large country—Great Britain—has recently arrived at the conclusion that the single rating is commercially impracticable, the users having definitely refused to adopt it.

*The present discussion specifically excludes steam and hydro turbo-alternators of large sizes, for which single rating was generally adopted long before the A. I. E. E. or the International Electrotechnical Commission adopted the single rating for any machines. The special reasons which led to that practice for turbo-alternators are still valid and the practice should be continued.

The original proponents of the single rating had in mind establishing a simple method of rating which would avoid the complications of measurements of temperature rise for two loads, i.e., normal load continuous and two-hour overload. They compromised by selecting the single rating at a point slightly lower than the overload limit of the double rating.

In selecting this compromise value they in effect boosted the old normal rating 15 per cent to 20 per cent and entirely dropped the overload rating. This naturally raised a strong protest from many consulting engineers, users and manufacturers who were dissatisfied with the lack of conservatism shown in the innovation.

The principal objection to the "normal and overload rating" arose from the fact that the percentage of overload and the period of its duration had never been standardized. In practice 25 per cent and sometimes 50 per cent overload was specified for periods of one, two or three hours, without stating the time intervals between overloads, so that it was very difficult to make comparisons between machines of different makes or from different countries. Hence it followed that the single rating as an international standard based on a uniform rise of temperature, which avoided all these complications, suddenly met with the favor of many, except for the criticism that the rise allowed for the single rating was too great and therefore not sufficiently conservative.

Returning now to the time when the double rating was universally practiced and having in mind the objections which made it unpopular, it is desirable to review afresh the whole problem and attempt to arrive at a new solution that may combine the advantages of both systems of rating.

This desirable solution can be reached readily if in our double rating we will omit the period in which the given overload will produce a specific temperature rise, but will prescribe that the overload rating shall refer to the ultimate temperature to be reached by the machine, regardless of whether it shall require one hour, or two or more, with the overload kept constant.

By this expedient the determination of temperature rise for overloads becomes exactly the same as for the normal load or, as a matter of fact, for the single-rating machine. To simplify the matter, the standard rules might specify for acceptance tests that only the overload tests should be required. This plan would overcome the original objections of the double rating. The plan is practicable and feasible for all classes of machines like motors, transformers, etc., and it is obviously proper to say that a motor having an overload rating of 25 hp. with an ultimate temperature rise of 55 deg. C. will not have to be of radically different design from a 20-hp., 40-deg. C. motor with two-hour overload at 25 hp. with 55 deg. C. There will be practically no differences for any rotating machine of any size where the time overload is two hours or more, for experience shows that within that period rotating machines in general reach within two or three degrees of the ultimate temperature, even in the case of the largest size units. For oil-cooled apparatus the time required to reach ultimate temperatures is more than two hours, but this fact will not handicap the plan suggested.

The suggestion of substituting the ultimate temperature rise for the overload rating is also justifiable from the advanced knowledge we have now of the relation between temperature and life of fibrous insulation. We know that treated fibrous insulation can withstand safely for short periods of time temperatures as high as 150 deg. and 160 deg. C., and that it can sustain continuously temperatures of 120 deg. C. for over two years without being destroyed. The characteristic life of a machine as affected by operating temperature of its insulation is represented by the curve reproduced. (See *A. I. E. E. Journal*, June, 1922, at page 446.)

This new knowledge of the properties of insulation gives us a new guide for the interpretation of the double rating of electrical machinery. It gives us the basis to rate the machines for normal load with a rise of temperature that will produce the longest and most economical life and for overloads with a rise that will not endanger the safe operation of the machine when carrying the occasional heavier load demands of the service as the demands arise. The meanings of the two ratings of normal load and overload are logically correlated to the practical requirements of the great majority of services of power application. With this clear understanding that in practice there exists a marked distinction between average or normal load of a service and the occasional maximum or overload requirements of power, the designer will direct his efforts to obtain the highest efficiency and highest power factor possible for the conditions of normal load and will tolerate relatively reduced efficiency for overloads, for which reduction in efficiency he will be allowed, without increased cost, to put into the machine more capacity for overloads than he would be able to obtain from the same amount of materials if used to produce a single-rating machine having the highest efficiency at that rating.

I think that the suggested plan will eliminate the enormous misunderstanding that has arisen from the hopeless attempt to consolidate in one compromise rating two things which are economically inconsistent with each other; that is, the capacity for normal load and the capacity for maximum load, each of which has a definite practical significance in application and service and which cannot both be economically and commercially covered by a single value. This is what has been attempted by the single rating. Without heat or prejudice let us now attempt to see whether the suggestion herein offered may not bring us all back to full mutual understanding.

PHILIP TORCHIO,
Chief Electrical Engineer.
New York Edison Company,
New York, N. Y.

A Misleading Patent Note

To the Editors of the ELECTRICAL WORLD:

I read in the record of electrical patents in the ELECTRICAL WORLD for Feb. 24 the following entry: "1,444,620. Air-Motor-Driven Generator; E. Lunn, Chicago, Ill. App. filed Sept. 12, 1921. Wind-driven generator for charging airplane batteries."

I appreciate the fact that only the briefest kind of information relative to a patent can be given in such a short note, but in this case the entry is misleading in that the patent does not refer in any way to charging airplane batteries. It covers a combination of an air motor, an electrical generator and gearing between the motor and generator, the idea being to make a more efficient combination of these three elements than has heretofore been assembled. No reference is made as to how the current generated should be used.

Pullman, Ill. ERNEST LUNN.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Where the Money Goes in the Building of Transmission Lines

THE diagram shown on this page illustrates how each dollar was expended in securing and preparing transmission rights-of-way and in erecting the towers and stringing the conductors for an 80-mile section of double-circuit, 100,000-volt steel-tower line requiring six No. 2/0 conductors and one ⅜-in. steel ground wire. It is based on very careful records kept by an electric service company in the Southeast. The cost of the materials used is not included. While the cost per mile of line erected is not available for publication, it can be said that it is very low and agrees well with the average cost obtained on this system in erecting about 200 miles of similar circuits this year.

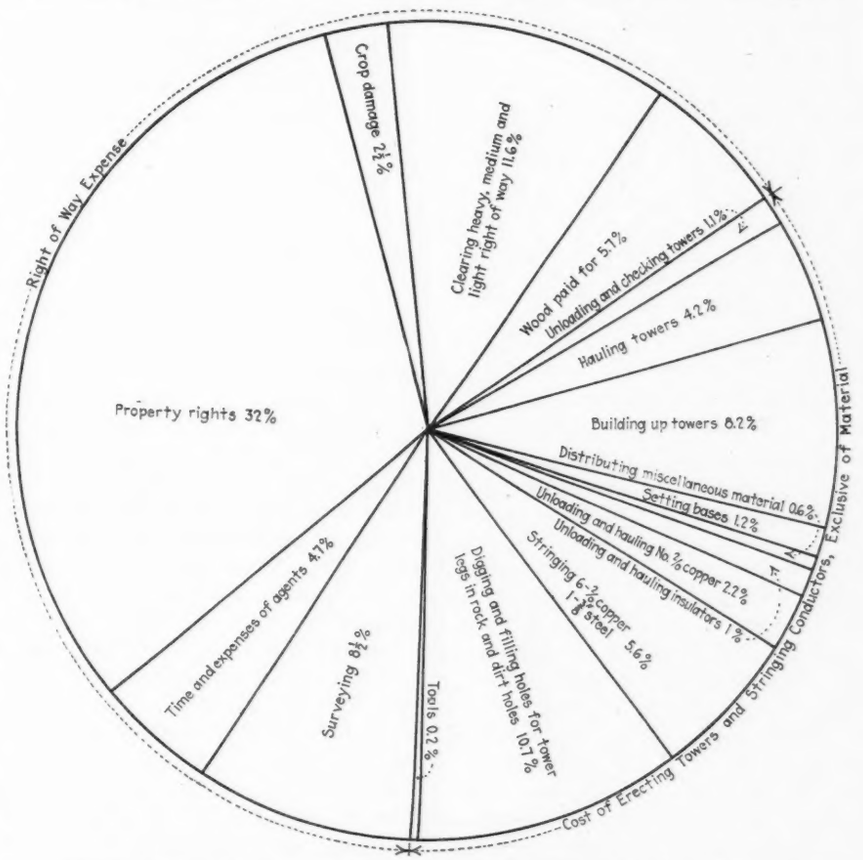
The figures for the right-of-way are a little unusual in that there was considerable difficulty in locating this particular line and therefore the item of surveying is almost double what it ordinarily is. The line also passes through rather heavily wooded country, and the item of clearing is considerably larger than usual. The expenses of the agents on this line were also high because of this heavy clearing.

The data on which this diagram is based were collected each day during the construction of the line and took into careful consideration the cost of labor for each item represented. Instead of lumping the camp expense, as is usually done, this expense was apportioned over the various phases of the work according to the amount of labor required for each phase.

It should be observed that the cost of no material is included; hence in determining what proportion each item of the expense bears to the total expense of constructing the transmission line it would be necessary to keep this in view. However, considering the items represented, it may be observed that property rights constitute 32 per cent of the total, clearing right-of-way 11.6 per cent, digging and filling holes for tower legs 10.7 per cent, surveying 8½ per cent, and building up towers 8.2 per cent. In regard to digging holes 22 per cent of the total number of poles were in solid granite, making it necessary to drill and shoot. All the remaining expenses are of less proportion, ranking in about the following order: Wood paid for, stringing conductors and ground wires, time and expenses of agents, hauling towers, crop damage, unloading and hauling copper conductors, setting bases, unloading and checking towers, unloading and hauling insulators, distributing miscellaneous material and tools.

The foregoing analysis indicates very closely where the greatest attention must be directed if the expenses of transmission and line construction are to be reduced.

The low cost of erecting the towers is attributed to the method employed. It is known as the unit method. Each gang for constructing these towers consisted of a foreman, two erecting crews of eight men each, one anchor setting crew of three men and sufficient men to dig and fill the holes with the anchors, the number depending upon the character of the soil encountered. One skilled and two unskilled laborers place the anchor. Templates were furnished, made up mostly of


Right of Way Expense
Crop damage 2½%
Clearing heavy, medium and light right of way 11.6%
Wood paid for 5.7%
Unloading and checking towers 1.1%
Hauling towers 4.2%
Property rights 32%
Building up towers 8.2%
Distributing miscellaneous material 0.6%
Setting bases 1.2%
Unloading and hauling No. 2/0 copper 2.2%
Unloading and hauling insulators 1%
Stringing 6-2/0 copper 1-⅜" steel 5.6%
Digging and filling holes for tower legs in rock and dirt holes 10.7%
Tools 0.2%
Surveying 8½%
Time and expenses of agents 4.7%
Cost of Erecting Towers and Stringing Conductors, Exclusive of Material

RELATIVE COSTS OF SECURING AND PREPARING RIGHT-OF-WAY AND ERECTING TWO-CIRCUIT TOWERS (EXCLUSIVE OF MATERIALS)

Based on 80-mile section of double-circuit, 100,000-volt steel-tower line carrying six No. 2/0 conductors and one ⅜-in. steel ground wire.

tower members, but it was found that the anchors could be placed without the use of templates, and they were therefore seldom used. The surveying party placed one stake at the center location for each tower and one at each side in the direction of the line.

Instead of assembling each tower on the ground in the usual manner and then hoisting it, the towers were built up entirely from the ground. This was made possible by making the splices and connections so simple and at such places that they could be easily connected while working upon the tower. Each erecting crew had four ground men and four men who could work above ground. After the bottom section of the tower was completely erected the erection crew was augmented to eight men, one man working on each corner of the tower and four remaining on the ground. One ground man serves as a dead man for a guide line attachment to the top of the tower and another serves on a tag line attached to the piece to be raised. The two remaining ground men attach and hoist the various members by means of a single block and line connected to the top of the pole.

CREW OF EIGHT MEN ERECTS THREE TOWERS A DAY

When the tower is completely assembled and the insulators are hung the four men who worked on the tower above ground start at the top and work down, tightening every bolt. The four ground men proceed to erect the first-story section of the next tower. After some experience one crew of eight men has erected as many as three towers per day.

On the particular line to which the diagram refers there were ten towers per mile on the average. The towers were specially designed and fabricated for this system of erection by the Riter-Conley Company.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

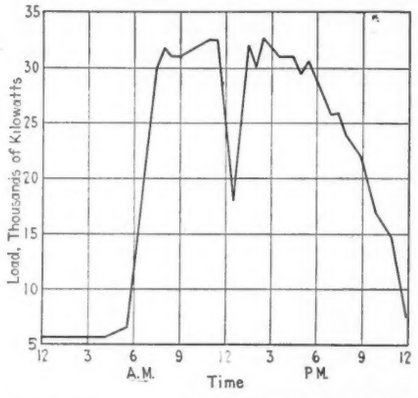
Setting Poles with Earth-Boring Machines

THE Detroit Edison Company has had splendid success with earth-boring machines and finds that two such machines care for the extension needs of the whole system. Poles are assembled with arms and hardware in place, and recently four men, one machine and six back fillers placed 133 35-ft. poles in one day. In January about 1,800 poles were set, and the remodeled International earth-boring machines have given good service for several years.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Fuel Cost 72 per Cent of Production Expense

DESPITE the increase in output which features central-station development and the improvement in even peak-load curves apparent in many plants, fuel cost remains the chief burden of production expense.



INDUSTRIAL LOAD OVERCOMES HOLIDAY PEAK AND AIDS PLANT ECONOMY

The accompanying production costs of the Worcester (Mass.) Electric Light Company for the year 1922 are typical. The plant is about 50 miles inland with no tidewater facilities for fuel handling and has a present rating of 55,600 kva. Six Stirling, two Edge Moor and six Bigelow-Hornsby boilers are in service, the steam pressure being 200 lb. and the superheat 100 deg. F. Eight-retort and fourteen-retort Riley stokers are used on the later boilers, Taylors on older units and Cox stokers on equipment burning anthracite.

During the year the company burned 66,956 tons of bituminous coal at a cost of $7.752 per ton and 13,613 tons of anthracite at $4.52. Two 7,800-kva. and two 20,000-kva. turbine units are installed, and the station output for the year was 73,256,100 kw.-hr. Itemized production costs at the station are given in the accompanying table.

The maximum load on the plant was 32,600 kw. and the year's load factor 25.6 per cent. The production cost was 1.097 cents per kilowatt-hour, of which 7.93 mills represented fuel expense. The accompanying load curve, taken Dec. 22, 1922, emphasizes the importance of power business to this plant, which sold during the year more than 39,000,000 kw.-hr. for power as against slightly under 18,000,000 kw.-hr. for commercial lighting. About 9,000,000 kw.-hr. was purchased from other companies.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Frozen Water in Generator Loosens Laminations

THE article on "Generator Breakdown from Loose Laminations" in the Feb. 24 issue of the ELECTRICAL WORLD, page 461, recalls an expensive experience with same results but from a different cause. While replacing an obsolete and unsatisfactory horizontal turbine with another in one of the Malone Light & Power Company's stations it became necessary to move the generator from its foundation to one side of the building. This was done in the winter. The power house being built into the side of a rock bank the wheels had to be lowered through the roof. During this time bad weather was encountered, and in some way water was allowed to get into the generator, which froze to such an extent that, as was afterward determined, the laminations were forced apart, loosening them so that when the machine was put into operation trouble was experienced with grounded coils.

PRODUCTION EXPENSES FOR 1922 FOR A 55,600-KVA. STATION

	Total Expense	Expense per Kw.-Hr., Cents	Per Cent of Total
Superintendence	$17,058	0.0233	2.13
Boiler labor	35,599	0.0486	4.44
Turbine labor	18,905	0.0258	2.37
Electrical labor	6,824	0.00933	0.86
Miscellaneous labor	7,109	0.0097	0.88
Boiler fuel	580,583	0.793	72.40
Water for steam	322	0.00044	0.04
Lubricants	3,653	0.00499	0.47
Station supplies, etc.	29,770	0.0406	3.75
Maintenance:			
Station structures	21,237	0.029	2.65
Boiler-plant equipment	31,059	0.0424	3.79
Turbine units	21,217	0.02895	2.65
Generating equipment	8,755	0.01185	1.09
Accessory electrical equipment	1,475	0.002015	0.02
Miscellaneous equipment	19,717	0.0269	2.46
Total plant only, not including overhead	$803,288	1.097	100.00

During the twelve years this generator has been in operation we have never been able to stop the vibrating of the laminations, although it has been overhauled several times and once was completely rewound.

In reference to the articles appearing in the ELECTRICAL WORLD under the title "Extracts from an Operating Code," the writer feels that they are of great benefit to central-station men and have added a value to the paper which cannot be estimated.

S. G. HUNTER,
Operating Manager.
Malone Light & Power Company,
Malone, N. Y.

Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Wound-Rotor Induction Motor Generators

WHEN starting wound-rotor induction motor generators from the alternating-current side with starting resistance the secondary current is limited by connecting the starting resistance in series with the secondary winding. By transformer action this limiting of the secondary current limits the primary current to a safe value even with full voltage impressed on the primary. Moreover, as the speed increases the current decreases because of the effect of counter-electromotive force; therefore the resistance is cut out, step by step, until full speed is reached with all resistance cut out. In some cases after the starting resistance has been completely cut out the collector rings are short-circuited and the brushes raised.

For starting and shutting down this type of machine, the Philadelphia Electric Company has issued the following rules to be followed by its employees:

STARTING

1. Make sure that the controller is in the starting position, and that the brushes are down on the rings.
2. Choose the alternating-current bus switch. The motor should then turn over.
3. As the speed of the motor increases cut out successively the steps of the starting resistance with the controller.
4. When running speed has been reached lift the brushes from the collector rings. This operation also short-circuits the rings by means of a short-circuiting bar.
5. After lifting the brushes, place the controller back in the starting position.
6. Close the generator field switch.
7. If the generator is compound-wound, close the equalizer switch.
8. Adjust the direct-current voltage to that of the bus and close the circuit breakers and the negative and positive machine switches.

SHUTTING DOWN

1. Reduce the load on the machine to be taken off to as low a value as possible.
2. Trip the direct-current circuit breakers and the machine and equalizer switches.
3. Open the alternating-current bus switch.
4. Lower the brushes to the collector rings.

Instructions for Taking a Boiler Off the Line

ACCORDING to the operating code of the Philadelphia Electric Company, points to be watched in taking a boiler out of service are (1) that the water does not get low after steaming has stopped and the fire is still burning; (2) that the boiler and setting are not cooled too rapidly, and (3) that all precautions are taken to block off outside sources of pressure, such as steam, feed water, blowdown and soot blowers, for the sake of personal safety and protection when the boiler is opened up. Following are the instructions for taking the boiler off the line:

1. Cut off the coal feed pipe.
2. Set the change-over valve on the waterback line for raw water.
3. Run the coal-feed pipes and hopper empty.
4. Cut off the stokers.
5. Shut off feed-water valves, keeping the water in sight above the nut on the gage glass.
6. After the coal in the furance is burned out, cut off all forced draft.
7. Shut off the spray line in clinker-crusher pit.
8. Stop both the induced and forced draft fans.
9. As the steam pressure drops shut the main stop valve.
10. Close the trap-line valve above the automatic non-return valve.
11. Lock the automatic non-return valve.
12. Open the vent valves on the superheater and open the drain valves between the main stop and automatic non-return valves.
13. Close the stack damper.
14. Shut off the waterback feed and discharge valves after the waterback soot chamber has been cleaned.
15. Empty the boiler through the blow-off valves when the setting has cooled. The superheater drain valves on the other boilers must be closed while this is being done.
16. When the boiler is empty, see that the safety stop valve in the blow-off line is closed and close all blow-off valves and cocks.
17. Hang danger signs on the main stop, main feed, blow-off valves and control board.

Stimulating Initiative and Placing Responsibility

ASKED as to what he considered the best method of making men develop within a company, one department head of a central-station company, who is a very able organizer and supervisor of men, said: "It is getting them to think." This is not always as simple as it sounds, but he suggests one method which has extensive application.

Every company has its mishaps and interruptions to service in varying degrees. Instead of himself anticipating what may happen and how the trouble shall be handled, the department head referred to puts the responsibility up to the men or man who may have to handle the problem—sometimes the boiler-room foreman, sometimes the switchboard operator, etc. He asks each one to imagine what might happen and how he would handle the trouble if it developed. Even if the man to whom the responsibility is given does not use good judgment the first time, it has been found that the mental process may stimulate his imagination and that this plus experience will bring good judgment. The department head makes it a point to go over these suggestions with the originator personally to ascertain why certain conclusions were reached and, where judgment is erroneous, to draw out a better suggestion.

This method has been found not only to make the men think more clearly about their jobs and plan for future contingencies, which is always a benefit when emergencies arise, but it lessens the monotony of certain jobs and makes the men who fill them feel that, after all, they are more than automatons.

To force men to think along these lines this department head always takes up with the man in charge any serious interruption or trouble after it has been cleared and reviews the situation to make certain that any lessons to be learned are absorbed. He also impresses it upon the men that avoidable interruptions are charged against them and that these interruptions can be minimized by constantly thinking over what may happen and how it shall be handled.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Park Cable Used Throughout St. Louis Parks

BY MEANS of buried or "park" cable the city of St. Louis has recently completed the work of supplying electricity to more than 3,400 ornamental lighting posts along the highways of its park system. These cables are single-conductor, insulated with 30 per cent rubber compound for 1,500 volts, and are protected against moisture by lead sheathing and against mechanical injury by spirally wound steel-tape armor. The trench in which the cables are buried is 2 ft. deep.

An unusual feature of this extensive installation is the fact that the trenches were dug with caterpillar trenching machines. The conditions in the parks are almost ideal for the efficient operation of such machines, and as almost 800,000 ft. of trench was dug, the economy was very substantial. Another interesting feature was the method of mounting six reels on a motor truck and paying out the cable as the truck slowly progressed along the line of the trench. The manner in which this was accomplished is shown in the composite picture on the front cover. The other photographs show the caterpillar trenching machine in operation and a view of a completed post.

It may be wondered why it should take nearly 800,000 ft. of trench and cable for 3,400 posts. This is because a separate cable has been provided for each side of the road, forming two independent series circuits, so that if anything happens to one circuit there will still be lights on the other side. Where the roads curve the lights are all placed on the outside of the bend and connected to the two cables in such a manner that only alternate lights will be extinguished if either of the circuits fails. It is evident that the city engineer is a progressive advocate of safe highways and means to guard against accidents due to insufficient lighting.

COST OF INSTALLING STREET-LIGHTING SYSTEM WITH 3,423 POSTS

	Cost per Post
Labor cost of trenching, laying in cable, filling in, digging post holes, setting and equipping posts, splicing, boring under streets where necessary, repairing road surfaces and curbs, fitting up substations, etc.	$35.44
Posts (made by city)	15.23
General warehouse expense, including electrical work on poles and switchboards, painting, loading and unloading, etc.	3.23
Cost of cable	40.00
Total cost per post (average of 3,423)	$93.90

That this method of lighting is not excessively expensive for a permanent installation where safety and appearance are of prime importance is shown by the costs in the accompanying table. The figure—$93.90 per post—includes everything except the cost of transformers and transformer houses.

The reasonableness of this figure is largely due to the low cost of trenching and laying the cable in the trench and the careful study of details. For instance, it was found that a saving of $2 per post could be effected by stripping the armor off the park cable and running it directly to the top of each post instead of using special wire in the posts. This not only eliminated two splices at the bottom of each post but also did away with the necessity of making an excavation at the base of each post large enough for a splicer to work in.

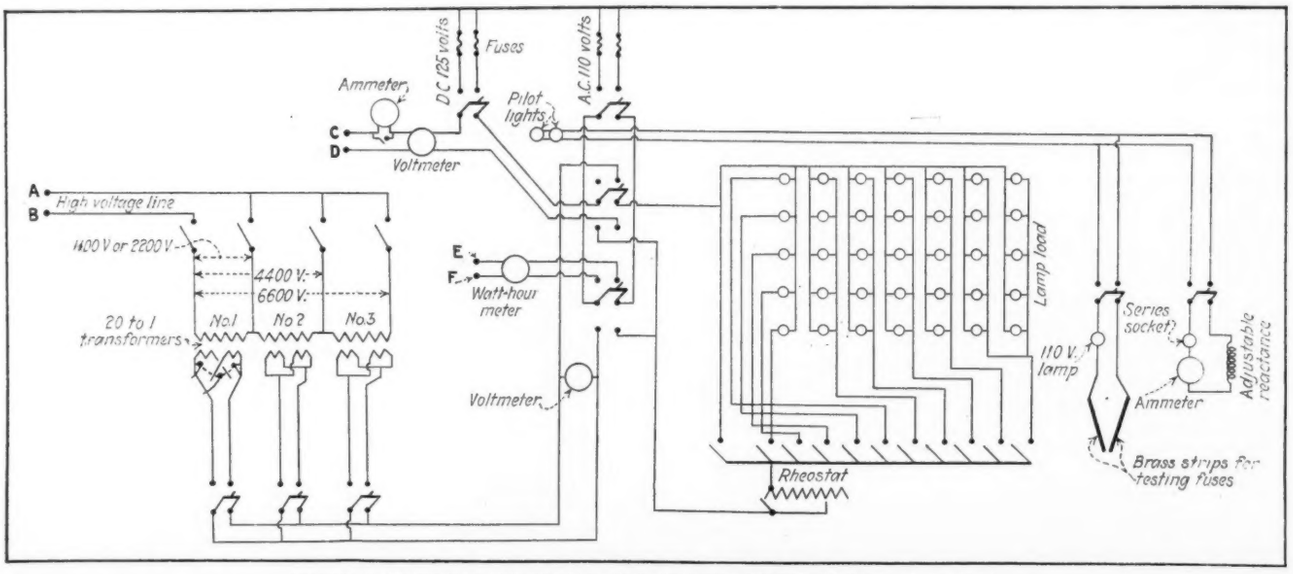
F. A. WESTBROOK,
Field Engineer.
Habirshaw Electric Cable Company.
Yonkers, N. Y.

Transformer Testing Apparatus

Panel Developed by Stamford Gas & Electric Company Utilized to Test Equipment in Minimum Time Has Worked Out Very Successfully

A TEST board for transformers, arc lights, etc., that has been in use by the Stamford (Conn.) Gas & Electric Company for several years and has proved very satisfactory is shown in the accompanying illustrations. The equipment is made up of standard wiring parts (sockets, snap and knife switches, etc.), three small line transformers and a home-made adjustable reactance coil for incandescent-street-lamp work. At the left of the diagram is shown the arrangement of the three 10 to 1 or 20 to 1 transformers, which, being energized from the 110-volt alternating-current source, can give 1,100, 2,200, 4,400 or 6,600 volts pressures for transformers or other insulation testing at the terminals *AB*.

At the right of the diagram and having the terminals *EF* is an in-



PANEL LAYOUT FOR TESTING TRANSFORMERS, STREET LIGHTS AND FUSES

tegrating kilowatt-hour meter which is used for obtaining the transformer no-load losses. There are two sources of energy supply, one service being at 125 volts direct current and the other at 110 volts alternating current. The former is used primarily for the testing and adjustment of magnetite-arc lamps and can be supplied at the terminals *CD* either at 125 volts or at a voltage controlled by the lamp load. This lamp load can also be inserted in the line feeding the testing transformers to limit the current on the breaking-down test for insulation. At the bottom of the lamp-load diagram is shown a small adjustable rheostat used for accurate voltage adjustment in setting the shunt-coil lift on direct-current arc lamps. At the right of the lamp bank is a device for testing cartridge fuses, and at the extreme right is an adjustable reactor for testing series alternating-current lamps and street-lighting transformers.

ALL TRANSFORMERS PASSING THROUGH STOREROOM TESTED

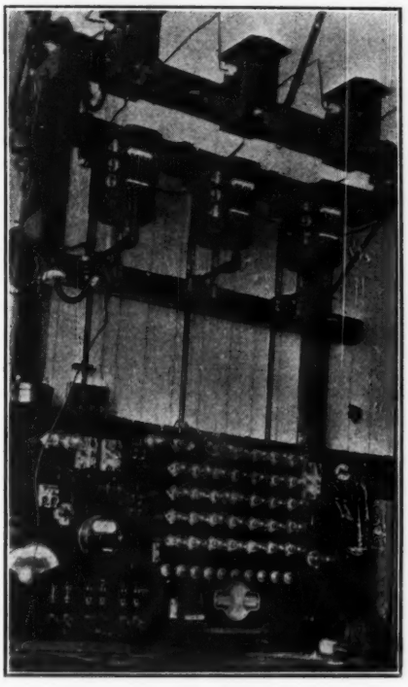
The routine use of the board for transformer testing is the same for new transformers as for those that have been on the lines and are brought in for load changes or on account of breakdown. All transformers passing through the storeroom, whether new, changed or apparently burned out, are tested and overhauled. Our system has two primary distribution voltages, the greater part operating at 2,200 volts delta and some at 4,400 volts delta-connected, three-phase. All transformers used on the latter have double primary coils and a terminal board for series or multiple operation.

The first operation in testing consists of putting 2,200 volts on the primary of the transformer under test and examining the secondary voltage. This is quite important, especially on transformers that have been hit by lightning and are liable to have part of their primary coils cut out.

If this voltage proves satisfactory, the insulation is tested between the high-tension coils and the case, the low-tension coils and case, and between the high-tension and the low-tension coils. In every case all terminals of each coil are connected together, the test being made with 4,400 volts (6,600 volts for transformers with double primaries).

The transformer is now repaired if necessary, the core pulled out and the coils scraped if badly covered with carbonized oil. The terminal boards in transformers that are relics of 1,100-volt primary days and any paper tags that may have been glued to the cover are removed, the latter especially being a fertile source of trouble on the older types of transformers.

After testing, cleaning and painting the case, the transformer is



COMPACTNESS A GOOD FEATURE OF THIS TESTING EQUIPMENT

again tested for insulation and is then tested for no-load loss. This consists of applying 110 volts to the secondary of the transformer through a kilowatt-hour meter and reading the input by timing the disk rotation with a stop-watch. The watts lost are recorded on a transformer history card, no attempt being made to separate these data into component parts or to correct for the actual value of magnetic flux the transformer would require. This must be done before the no-load loss of various transformers may be even approximately compared, as part of our line transformers (power) are of 9 or 18 to 1 ratio and part (lighting transformers) 10 or 20 to 1 ratio, and the no-load losses may be roughly compared by proportioning the square of the secondary voltages.

No tests for heating or regulation are made in routine. The writer does not believe it worth the time it would take on transformers of standard manufacturers, whose designs are well determined, and which have stood the insulation test.

The test board is located on the second floor of a building served by a power elevator so that line transformers of practically any size can be handled easily.

PORTABLE TEST OUTFIT

In case handling facilities are not available, a testing apparatus which the writer devised a few years ago and used at the Hackensack office of the Public Service Electric Company of New Jersey is very satisfactory and convenient.

Two 1-kva. transformers were mounted on a wooden platform about 8 ft. square and fitted with casters. On one side of the platform was a vertical wooden switchboard about 2 ft. high and 3 ft. wide, which held a fused 30-amp., 110-volt switch, a small adjustable 110-volt circuit breaker and three plug switches, such as are used on series street-lighting panels. The low-tension sides of the transformers were permanently connected in multiple through the switch and circuit breaker and the high-tension sides were connected in series, leads being brought to the plug switches and from them to terminals. By this arrangement test voltages of 2,200 volts or 4,400 volts were obtained, and either transformer was large enough to supply exciting current to any line transformer for testing its ratio. This set could be carried quite easily from place to place and used wherever 110-volt service was available.

CHESTER S. WENDELL,
General Foreman Line Department.
Stamford Gas & Electric Company,
Stamford, Conn.

Rubber-Covered Wire for Underground Service

ABOUT five years ago the Buffalo General Electric Company installed rubber-covered wire for the underground street-lighting service. The cost ratio was about three to one in favor of the rubber-covered wire. No. 8 wire, rated at 5,000 volts with $\frac{7}{32}$-in. rubber insulation (30 per cent para rubber), was used in a $2\frac{1}{2}$-in. fiber duct laid between the lamp pedestals.

Each length of wire was pulled from one lamp to the next. Some of these conductors have frequently lain in water or in ice, yet the service has been completely satisfactory and the practice has been continued for later installations.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Grading Utilities on Service Rules*

Means Adopted by the Railroad Commission of Wisconsin for Maintaining Service Standards and Determining Relative Performance of Lighting Companies

BY CHARLES B. HAYDEN
Service Engineer Wisconsin Railroad Commission

THE first order issued by the Railroad Commission of Wisconsin prescribing certain requirements for gas and electric service was made effective in 1908. The second order, which is now in effect, was issued in 1913. Very soon after the last order came out, early in 1914, the service department began grading the gas and electric utilities, and about a year or so later, in 1915 or 1916, standings were given to the telephone utilities. Up to this time we have not attempted to grade the water utilities, although service rules have been in effect for about four years. There does not appear to be any great advantage, as far as our department is concerned, in applying grades to the service of water utilities, since the quality of service with different municipal and private utilities does not vary much.

When this system of grading was started it was not with the thought of applying to the regulation of utilities the time-tried plan of grading as used in our school system, where it is absolutely necessary in order to keep the pupils placed according to the achievement and growth which each one makes; nor was it our idea that each utility would be expected to run the gamut of conditions, passing and honor marks through the various years of the course, with the possibility of failure up to the final graduation. It was done because it afforded a means of keeping track of the utilities according to the service standards which had been established, and if possible to determine whether there was any increase or decrease in the degree of compliance from year to year, of the utilities throughout the state or of any one utility in particular.

After use in this way for some time it was determined to try out the scheme on the unsuspecting utilities, and it was found that the results were decidedly good. The utilities which received high rank were very much pleased and in almost every case put forth efforts to improve their position or at any event maintain it. To be sure, some jealousy developed, but for the most part the best of feeling existed and a friendly rivalry sprang up for the high-rank positions.

The rules do not have equal relation to the quality of the service; for instance, the meter-history record has no particular bearing on service, while the pressure conditions and meter-testing practice will determine greatly the degree of satisfaction felt by the consumer.

The rules are also subject to quite wide interpretation and the inspector must make this decision. To be sure that this will be worked out uniformly by the engineer inspectors—all of our inspectors are engineering college graduates—conferences have been held about twice a year, when sample inspection reports receive a mark; i.e., each rule received a percentage from each inspector according to the report. These marks are then compared and the differences argued out by the several inspectors, until it is possible to have a close approximation to uniformity.

In order to avoid too great variation, the different rules are divided, where this is possible, into their elements and a portion of the percentage is allowed for each subdivision. In the detailed explanation of the markings this will be followed out. The weighing of the various rules for gas and electric service was decided after a number of conferences of all the inspectors, and we believe that the result is reasonably proper.

For electric service, interruption and voltage variation hold first place, periodic tests second, accuracy of meters third, and the rest of the rules are of about equal value. The table gives an idea of the plan.

It is obvious that the instance would be rare of a utility which could give perfect voltage or pressure conditions over its entire system all of the time, but it is possible that such a condition could exist. Naturally the full allowance of 18 per cent is seldom if ever given. An analysis of the company's records and of the inspector's tests will give a good idea of the extent of poor pressure conditions, and penalties are imposed in proportion to the extent and to the importance of the business affected. With most of the rules, however, it is quite possible for the utility fully to meet the requirements and receive full credit.

Some of the rules applying to electric companies, with explanation of the reasons for the grades given, follow:

Interruptions, 18 per Cent (Rule 23).—Each electric utility shall make all reasonable efforts to eliminate interruptions in service and when such interruptions occur shall endeavor to reestablish service with the shortest possible delay. Whenever the service is interrupted for the purpose of working on lines or equipment this shall be done at a time which will cause the least inconvenience to consumers, and those most seriously affected by such interruption shall, if possible, be notified in advance.

Compliance with this rule is based

RULES REGARDING ELECTRIC SERVICE

Number of Rule	Subject	Per Cent Credit	Rank
14.	Creeping meters	4	6
15.	Accuracy of meters	7	3
16.	Installation tests	5	5
17.	Periodic tests	14	2
18.	Meter-testing records	5	5
19.	Meter-testing equipment	5	5
20.	Request tests	4	6
21.	Referee tests	..	..
22.	Meter readings on bills	4	6
23.	Interruptions	18	1
24.	Station records	6	4
25.	Pressure and voltage variation	18	1
26.	Pressure and voltage surveys	6	4
27.	Information	4	6

*Abstract of paper presented at conference of railway and utility engineers at Washington, D. C., March 2, 1923.

upon the number of interruptions to service, the length of interruptions, and on whether they are reasonably avoidable or not. Some weight is also given to the class of consumers served and whether or not the interruptions affect the whole, a major portion or only a small part of the system. Interruptions of the whole service are classed as follows in per cent credit: No interruptions, 18; few short, unavoidable interruptions, 18; few long unavoidable interruptions, 16-17; few short, avoidable interruptions, 15; few long avoidable interruptions, 12; many short, unavoidable interruptions, 12; many long, unavoidable interruptions, 10; many short, avoidable interruptions, 5; many long, avoidable interruptions, 0.

Station Records, 6 per Cent (Rule 24).—Each utility furnishing electric service shall keep a record of the time of starting and shutting down power-station equipment and feeders, together with the indication of the principal switchboard instruments, at sufficiently frequent intervals to show the characteristics of the load, and shall maintain a record of all interruptions of service upon the entire system or major divisions of its system, and include in such record time, duration and cause of each interruption.

A complete station log will constitute full compliance, but if it lack a record of interruptions, showing cause, duration, etc., only half to two-thirds credit will be given.

Pressure and Voltage Variation, 18 per Cent (Rule 25).—Each electric utility operating in a city having a population of 1,500 or more shall adopt a standard voltage for the entire constant-potential system and shall maintain the voltage within 3 per cent of such standard on all lighting circuits during lighting hours; on power circuits and during other than lighting hours the voltage shall be maintained within 10 per cent of the standard. All other electric utilities shall maintain their voltage regulation on constant-potential circuits during lighting hours so that the maximum voltage furnished any consumer shall not be more than 6 per cent above the minimum voltage at that consumer's cut-out.

A large percentage, about 15, is given if the pressure requirements are met during lighting hours and 3 per cent for the remainder of the twenty-four hours. With utilities not giving service except during lighting hours compliance is figured on the whole 18 per cent. Deductions are made depending on the amount of variation from the standard voltage and for variations below the standard on parts of the system.

Pressure and Voltage Surveys, 6 per Cent (Rule 26).—Each utility furnishing electric service shall provide itself with one or more portable indicating voltmeters, and each utility serving more than 250 consumers shall have one or more portable graphic recording voltmeters, these instruments to be of a type and capacity suited to the voltage supplied. Each of the utilities shall make a sufficient number of voltage surveys to indicate the service furnished from each transformer and feeder and to satisfy the commission of its compliance with the voltage requirements, and those having graphic recording voltmeters shall keep at least one of these voltmeters in continuous service at the plant, office or some consumer's premises. All voltage records are to be kept open for public inspection.

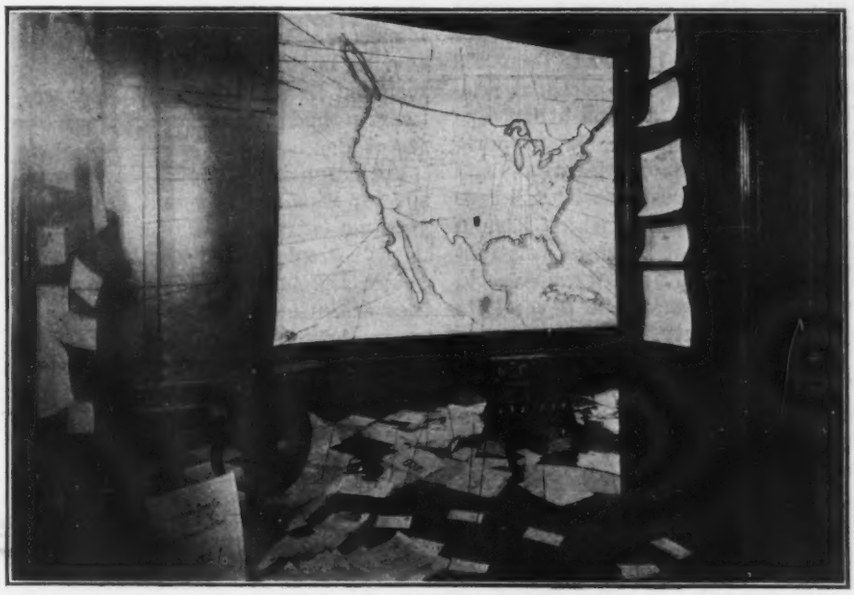
The compliance with this rule depends on whether or not the utility is fully equipped with recording gages and the judgment used in making the surveys as to the proper time and the location of the gages, etc., and whether or not a complete and available record is kept for inspection. Deductions will be made depending on the degree to which the inspector feels that the surveys are incomplete.

Information, 4 per Cent (Rule 27).—Each utility supplying electric service shall specifically inform each of its consumers as to the conditions under which efficient service may be secured from its system and render its consumers reasonable assistance in securing incandescent lamps and other appliances best adapted to the service furnished.

A utility is required by this rule to advise the consumers properly regarding the best lamps and motors to use, etc., and, in general, to show a proper attitude to the public. The public policy of the utility is another factor which is considered in connection with this rule. The degree of compliance must be determined from observation by the inspector.

Alabama Power Displays Broadcasting Results

THE window shown here was decorated by the Alabama Power Company to show the people of Birmingham the scope of WSY, the new broadcasting station which the company recently installed in a department store in that city. Every place from which letters have come is marked on a map of the Western Hemisphere with a red ribbon which extends down to the floor pointing to the letter itself, which is opened so that it may be read with ease. There are several hundred of these letters from all sections of the country, as far west as the Pacific Coast, northeast to Maine and south to Cuba. One ribbon indicated a point in Mexico 1,500 miles from Birmingham, and another a point in Canada 2,000 miles away. The display attracted much interested attention during the time it remained in the window.



WINDOW DISPLAY SHOWS SCOPE OF RADIO SERVICE

Weekly Meter Readings Prevent Disputes

THE Ohio Gas & Electric Company, Middletown, Ohio, L. E. Marshall, general manager, has adopted a practice of reading the meters of large consumers weekly. When a consumer uses so much power that the monthly bills are well up into the hundreds of dollars, no company can afford to have debates as to the accuracy of his bills. By the weekly reading of meters it is

possible to check any unusual use of power, real or apparent, and to make note of it or make adjustment in case it is a meter error, before any large sum is involved. This practice has been followed for three years, and during that time there has not been a disputed bill, whereas before there were occasional disputes with large customers.

Bills are rendered on the usual monthly basis. The weekly reading is merely an insurance measure, and it has proved well worth the expense and trouble involved by anticipating complaints on high bills.

Inspections Build Business and Good Will

Ten Years Experience by a Michigan Utility Indicates Value of Cordial Relationships—Inspector Sells Lamps and Appliances from an Electric Truck

By H. A. Fee
President Citizens' Light & Power Company, Adrian, Mich.

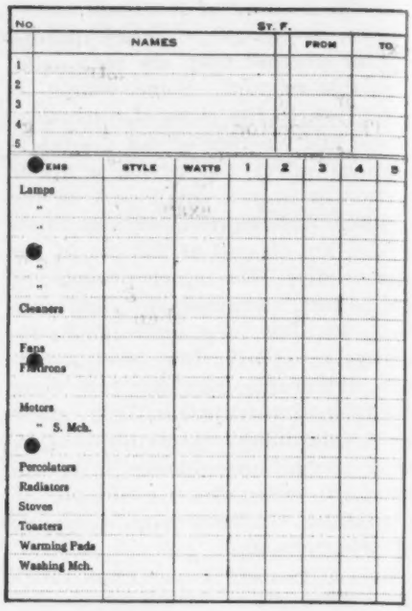
MAINTAINING customer good will and keeping energy-consuming devices on the line is a problem of no less importance to a small public utility than it is to a utility serving several hundred thousand customers. Often the personal relationships between a small utility and its customers can be, if properly handled, much more intimate and cordial than is possible with a larger utility. The extent to which a small utility will benefit by these relationships will depend upon its service to its customers "above and beyond its actual call of duty."

One of the most effective methods of having consumers view their local company in a favorable light is a free inspection service. Such a service has now been in use in Adrian, a city of twelve thousand inhabitants in lower Michigan, since 1912. During 1922 our inspector made twelve thousand visits among our three thousand consumers. This inspector follows the regular meter route with an electric truck carrying lamps and appliances, which he demonstrates and sells. He works the territory on schedule so that four complete inspections are made yearly. This work has continued ever since it was started, with the exception of the war period. At that time our inspector entered the nation's service, but the inspection trips were resumed in the year 1919 after customers had urged that they be restored.

Although in the beginning the inspector reported frequent trouble in gaining entrance because of housewives' suspicion of the company's object, the service is now so popular that oftentimes a customer will call up to determine just when the inspector will be around again. With such intimate contact with customers no introduction card is presented, although the inspector always carries credentials explaining the purpose of the investigating service.

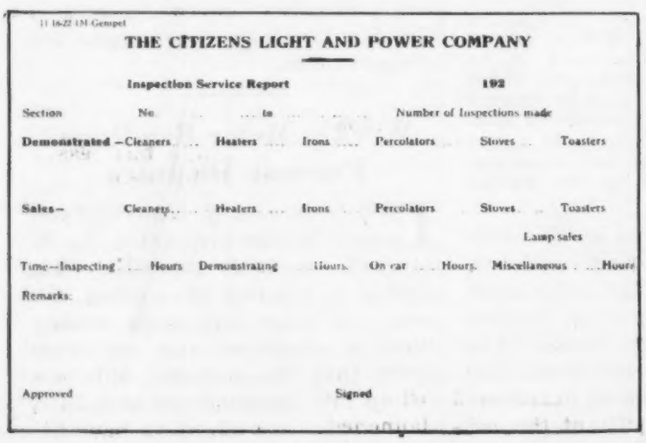
Note Book Lists Appliances

A loose-leaf notebook is carried by the inspector which gives the name and address of each customer. It also has room for four additional names in case any new tenants move in. White sheets are used for residential customers, while for commercial users buff colored sheets are used. Space has been provided to enter the number and the wattage of lamps and to list the appliances in use. However, as a result of protests from some residential customers against the visiting of all rooms in search of outlets or to determine the lamp wattages, the inspector now merely asks the number of outlets and figures the residence load on the basis of a 50-watt equivalent per socket. On the reverse side of this sheet columns are provided for the date of inspection, demonstrations and remarks regarding the quality of service. Careful note is made of all comments. If the complaints are not remedied by the inspector on the spot, he refers the subject to the repair department, which issues a regular work order



No.	St. F.						
	NAMES			FROM		TO	
1							
2							
3							
4							
5							
ITEMS	STYLE	WATTS	1	2	3	4	5
Lamps							
"							
"							
"							
"							
Cleaners							
Fans							
Flatirons							
Motors							
" S. Mch.							
Percolators							
Radiators							
Stoves							
Toasters							
Warming Pads							
Washing Mch.							

INSPECTION BLANK USED IN CHECKING WATTAGE OF LAMPS AND APPLIANCES USED



11 16-22 1M Gempel

THE CITIZENS LIGHT AND POWER COMPANY

Inspection Service Report 192

Section No. ... to ... Number of Inspections made

Demonstrated—Cleaners ... Heaters ... Irons ... Percolators ... Stoves ... Toasters

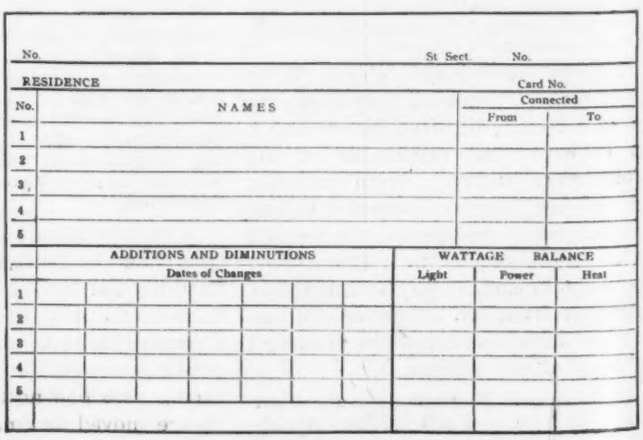
Sales— Cleaners ... Heaters ... Irons ... Percolators ... Stoves ... Toasters

Lamp sales

Time—Inspecting ... Hours Demonstrating ... Hours. On car ... Hours. Miscellaneous ... Hours

Remarks:

Approved Signed



No.		St. Sect.	No.		
RESIDENCE				Card No.	
No.	NAMES			Connected From	To
1					
2					
3					
4					
5					
	ADDITIONS AND DIMINUTIONS Dates of Changes			WATTAGE BALANCE Light	Power	Heat
1						
2						
3						
4						
5						

LEFT—INSPECTOR'S DAILY REPORT BLANK, GIVING APPLIANCES SOLD AND REPAIRED. RIGHT—PERMANENT FILE CARD, SHOWING DATA OBTAINED FROM INSPECTOR'S NOTEBOOK

for repairs. It is also his duty to explain any interruptions to service and to bring about adjustment on real or fancied grievances.

The inspector makes an investigation of the service, looking for low-hanging wires, loose brackets or switches and examines service entrance switches. He also inspects appliances. Minor repairs on appliances, sockets or wiring are made free of charge, but when further repair work is required the device is taken to the store with the customer's permission and repaired, this work being charged for according to the material and labor required. Labor in repairing appliances is generally furnished free, however, provided that the time consumed does not exceed fifteen minutes.

After doing his best in repairing appliances and bringing service to the 100 per cent mark, the inspector tactfully suggests the use of some other appliance the housewife needs. If she appears interested, he steps out to his truck and brings it in. By effectively demonstrating its use he is often able to overcome reluctance to purchase. The sight of an appliance in actual use in the home often is the main selling point in closing a sale.

The part of the service most appreciated by the customer is the sale of lamps. Customers are prone to forget to buy lamps to replace those burned out and as a result of this forgetfulness get along with a lower consumption of energy than normal, without any desire to practice rigid economy. The fact that most of our sales from the truck are of lamps shows that the service helps to keep the sockets full and in use.

After the day's work the inspector makes out a report showing the number of appliances demonstrated, the number of sales made and the number of hours devoted to inspection. These reports are checked daily by the secretary of the company, who supervises the service. No itemized lists of various types of appliances inspected has been kept, since this would involve extra time for an office clerk in filing and making out reports. The inspector's route books are turned over to a listing clerk who posts upon permanent cards the load data contained therein. From these cards figures are taken when calculating the distribution capacity required by the residential consumers.

From the results of this service in keeping appliances in good working condition, together with the spirit of good will fostered by maintaining an effective contact with the company, we have found that the improved customer relationship more than offsets the expense of the service itself, which last year cost us only $1,692. When the customer is made to feel that the company is directly interested in seeing that he gets good service he soon comes to realize that it is made up of human beings like himself and that its officers and men alike are interested in giving him personal as well as mechanical service. With this attitude bills are cheerfully paid. From our early experience we came to believe that the average customer appreciated the convenience of being able to get new tungsten lamps from the inspector far more than he did the saving he made in the cost per candlepower of his lighting service. It was the personal element of the service that appealed to him, and so beneficial have been the results from our free inspection that we would not think of doing without it. We believe there is no better way of building up good will.

Telephone Courtesy Shows Results

AS PART of a "courtesy" campaign the Scranton (Pa.) Electric Company has placed the card reproduced here on the transmitters of all the telephones in its general and departmental offices. This action is an outgrowth of the theory that "the voice with the smile wins," and almost immediate results were real-

SAFETY - COURTESY - SERVICE
"Make Every "Patron a Friend"
ELECTRIC
SERVICE
Every word spoken over this phone should mean service & friendliness.
THE VOICE WITH THE SMILE WINS

CARD PROMOTES TELEPHONE COURTESY

ized by the company in the form of commendatory letters from customers who had noticed the cards and were moved to compliment the company on the general courtesy of its employees.

What Other Companies Are Doing

Chicago, Ill. — A booklet, "Electrify Your Savings," has been prepared by the Commonwealth Edison Company for increasing the sale of stock by the company's investment department, the Utility Securities Company. The fourteen pages are given over to an interesting conversational narrative in which a suburbanite discusses the advantages and value of holding the company's stock, which has been sold to 29,000 persons.

Birmingham, Ala.—The Alabama Power Company is exhibiting in every state in the country a series of three industrial moving pictures showing the industrial and manufacturing plants of Alabama. These pictures are being sent out by the publicity department of the company to every national industrial exposition held in the country as a part of its program to attract new industries to the state.

Augusta, Me.—The Central Maine Power Company will rebuild its offices and stockroom at Waterville, recently destroyed by fire. A number of new electric stores have recently been opened on the system and the outlook is excellent for the year's appliance business.

Philadelphia, Pa. — During its annual spring washing machine campaign, which closed on March 31, the Philadelphia Electric Company sold 900 washing machines. Other types of washers sold brought the total to 1,000 for the six weeks. On the closing day 101 machines were sold, the day's total sales amounting to $19,000. Sales for March totaled $175,000, the largest month's business in the history of the company's electric shop. Merchandise sales for the first three months this year show an increase of 80 per cent over the same period in 1922.

Franklin, Mass.—Active cultivation of electric range business by the Union Light & Power Company has resulted in the installation of 145 ranges on its system, the total number of customers being about 4,000. E. S. Hamblen, local manager, states that the range "bogey" this year is 100 and that an installment proposition of $99 per range wired in place is about to be launched. The company is under the general management of C. D. Parker & Company, Boston.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Electric Steam Generators.—W. P. MUIR.—The author describes what is asserted to be the largest and most successful installation of the water-resistance electrode type of electric generator. This type has been used in Europe for a number of years and was recently introduced into Canada and further developed by the Shawinigan Water & Power Company, Shawinigan Falls, Quebec. Excess hydro-electric power is sold to the Laurentide Company, where two units, each consisting of three sections connected on a 6,600-volt, three-phase circuit, produce steam. Each generator has a normal capacity of 25,000 kw. and 35,000 kw. during overload. The generators are capable of producing 50 tons of steam per hour. —*Power*, Feb. 6, 1923.

Trent River Development Yields 10,000 Hp. to Central Ontario.—A new hydro-electric generating station of 10,000-hp. capacity was recently put into operation at Ranney's Falls on the Trent River in Ontario. This station is the most recent addition to a chain of seven developments that supply energy to the Central Ontario system of the Hydro-Electric Power Commission of Ontario. A head of 48 ft. is utilized in two turbines of the vertical single-runner type, directly connected to 4,500-kva. generators. Details of the turbine and generator installations, relay operation and switchboard accommodations are given.—*Electrical News*, March 1, 1923.

Generation, Control and Switching

Static Condensers.—C. MARMY.—The design of the usual type of static condensers, wherein layers of metal are placed mechanically upon dielectrics of paper, mica or glass, has resulted very frequently in failures due to either inclosed air pockets or the so-called "border effect," both causing a slow brush discharge which leads sooner or later to a puncture. The paper under notice describes a type of condenser which, it is claimed, avoids these two shortcomings. Upon both sides of a narrow and very long ribbon of "cellon," a substance similar to celluloid but non-inflammable, a chemical metallic deposit is made somewhat narrower than the width of the ribbon. Judging from the illustrations, this ribbon has about the dimensions of a standard motion-picture film. This ribbon is wound upon small bobbins, several of which are stacked up, connected in series and placed within an insulating tube, representing a condenser unit. For outdoor service these units are capped with a rain-shedding porcelain petticoat. By a special method, the nature of which is withheld, the edges of the metallic deposit are made of a very high ohmic resistance, so that the potential near the edges of the condenser ribbon is much smaller than in its middle portion, thereby avoiding the dangerous "border effect."—*Bulletin Association Suisse des Electriciens*, January, 1923.

Automatic Control of Synchronous Industrial Motor-Generator Sets. — An article describing a full automatic-control equipment for a 2,300-volt synchronous motor driving a direct-current generator, which is also automatically controlled by standard apparatus. A complete wiring diagram of both the motor and generator is given.—*Power*, Feb. 13, 1923.

Frequency Doubling Devices. — Y. WATANA. — Wave distortion of two highly saturated transformers and current-rectifying apparatus are two methods for obtaining double frequency. Both are based on the fact that when the magnetic flux through a coil undergoes the change of a half wave of a sinusoidal curve, lasting only for that half period, a complete wave of current of nearly double frequency may flow through the coil circuit. The writer shows that the latter method can be greatly improved by means of direct-current magnetization applied in the opposite direction to the magnetization of the rectified current. He also treats experimentally the direct method of deriving alternating currents of higher harmonics from a sinusoidal current source. — *Journal of the Institute of Electrical Engineers of Japan*, February, 1923.

Transmission, Substations and Distribution

Possibilities of Transmission by Underground Cables at 100,000 Volts to 150,000 Volts.—A. M. TAYLOR.—This paper is primarily a plea for the use of single-phase cables. The effect of separating the cores is considered, both in its relation to easing the potential gradient and in relation to eddy currents induced in the lead sheathing. The gain effected by employing "intersheaths" is pointed out, and the author's proposals for obviating the disadvantages of intersheaths by combining their employment with a six-phase transmission are considered. An actual transmission of 50,000 kw. at 100,000 volts over a distance of 30 miles is worked out in detail and compared with a similar transmission at 30,000 volts. The principal conclusions arrived at are: (1) Reliability under the six-phase three-phase system very greatly increased, as compared with plain single-core cables (as at Gennevilliers) or with three-phase cables for equal voltage. (2) The author's arrangements will permit loads of poor power factor to be taken up, with positive gain in efficiency and regulation. (3) The maximum voltage gradient being no greater with 100,000 volts than with 30,000 volts, such transmissions can be undertaken immediately the cable makers are in a position to guarantee the cables. (4) The investment in capital outlay proceeds, in the six-phase three-phase scheme, in proportion to the development of the load. (5) The reduction in line-charging current and the improvement in regulation are very considerable, as compared with those for any other proposals.—*Journal of the Institution of (British) Electrical Engineers*, February, 1923.

Steel Aluminum Cables for Overhead Lines. — H. KRAUTT. — An elaborate theoretical treatise on the properties of bimetallic cables, primarily dealing with the mechanical relations between the two metals. In spite of the large amount of scientific research work which has been carried on to study the physical properties of steel-aluminum cables, much has yet to be investigated to establish fully the feasibility of the use of these combination conductors. It has been definitely established that results found by calculations or from using short cable lengths in laboratories differ considerably from actual results with long transmission lines of the same material. The main difficulties are found in inability to measure accurately the existing stresses in the two metals and in the lack of exactness in measuring the cable temperature during artificial heating of the conductor. — *Elektrotechnik und Maschinenbau*, Feb. 18, 1923.

Units, Measurements and Instruments

Electric Test Brakes. — C. REINDL. —To determine the mechanical output of prime movers of electric motors and to test the characteristics of generators the author advocates electric braking methods, describing the equipment. A universal testing apparatus and switchboard which will take care of virtually all routine testing in repair shops is described in full detail. Particular attention is paid to the use of brake dynamos both rotor and stator of which are free to rotate. A lever attached to the stator carries a sliding weight or may be connected to a dynamometer. Providing a lever 710 mm. in length, the mechanical output of the tested motor in horsepower is simply the speed times the weight in kilograms over 1,000. A further simplification may be obtained by having the lever actuate a hydraulic measuring cylinder which is connected to a registering pressure gage. It is suggested that advantage be taken of regenerative braking, which will give a saving of 30 per cent to 40 per cent of the electrical energy otherwise required. A diagram is shown of a testing equip-

ment for automobiles, where the rear wheels of the car stand on large wooden drums, which drive two braking dynamos.—*Elektrische Betrieb*, Jan. 24, 1923.

Direct-Current Cable-Testing Car.—W. PFANNKUCH. — Testing of underground cables with high-voltage direct current, which eliminates all wattless currents met with when using alternating current, has the advantage of permitting more severe test of the cable and joints. By using direct current the charging energy of the cable has to be supplied only once, so that a very small amount of energy will be sufficient for any length of cable, the time required for the charging being of no importance. A portable plant of this type is described which consists of a 10-kva. single-phase, 220/33,000-volt transformer, one three-phase synchronous motor connected to a Delon type rotating mechanical rectifier, two condensers of 0.01 mf. capacity each and a sphere-gap voltmeter. A maximum of 150,000 volts direct current is obtainable. A voltage regulation from zero to the highest value is achieved by a special design of the synchronous motor, the stator of which can be so turned relative to the rotor that the rectifier will pick up any value of the alternating-current sine wave.—*A. E. G. Mitteilungen*, January, 1923.

Illumination

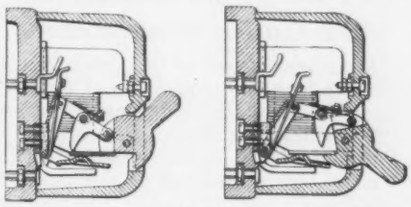
Illuminating Engineering Society Notes.—This issue of the *Transactions* includes three papers that were presented at the Swampscott convention last fall, with the complete discussion following their presentation. They are: "A Distribution Photometer of New Design," by C. C. Colby, Jr., and C. M. Doolittle; "The Regular Icosahedron as a Substitute for the Ulbricht Sphere," by K. S. Weaver and B. E. Shackelford, and "Lighthouses and Light Vessels," by S. G. Hibben. Abstracts of these papers may be found in the ELECTRICAL WORLD for Oct. 7, 1922, page 783; Oct. 28, 1922, page 948, and Nov. 11, 1922, page 1060, respectively.—*Transactions of the I. E. S.*, March, 1923.

Motors and Control

Steel-Mill Cranes and Mill Motors.—A symposium of six papers dealing with steel-mill crane and motor problems, crane-wiring diagrams, a 120-in. motor-driven plate mill, motor-driven accumulator pumps and foot-operated control for steel mills.—*Proceedings of Association of Iron and Steel Electrical Engineers*, February, 1923.

Operation of Induction Motors in Cascade. — H. COTTON. — In a highly mathematical paper the author draws the circle diagram of two induction motors in cascade by elaborating the diagram of one machine functioning under normal conditions. In order to simplify the diagram the case considered is that of ideal motors in which the copper losses are so small that they can be neglected. This means that the generated electromotive force in the main rotor and the back electromotive force in the auxiliary rotor will be equal and opposite. But the directions of rotation of the two rotors are the same, the shafts being mechanically coupled; hence the fluxes which produce these electromotive forces must be in phase with one another when drawn on the same diagram. Moreover, assuming identical windings on the two rotors, the two fluxes must be equal in magnitude.—*Journal of the Institution of (British) Electrical Engineers*, February, 1923.

Miniature Automatic Breaker.—As a substitute for fuses in house installations, a small, single-pole automatic switch not much larger than an ordinary wall switch is described. This is shown in the accompanying illustration. The rating of the switch is for 6 amp. and for 10 amp., up to 250 volts. A double-toggle joint brush contact is controlled by the adjustable armature of a small solenoid. The coil acts at the same time as a magnetic blow-out for the arc. On tests the breaker opened on 250-volt short-circuit currents of as high as 1,500 amp. without trouble. It was further demonstrated that the switch will open short-circuit currents of up to 400 amp. from 110 volts to 220 volts quicker than the 25-amp. plug fuse customary in light circuits.—*Elektrotechnische Zeitschrift*, Feb. 15, 1923.



INSTANTANEOUS AUTOMATIC BREAKER ADAPTABLE FOR PROTECTING HOUSE CIRCUITS

Traction

Control of Alternating-Current Locomotives.—I. DÖRY.—Electric control of large locomotives with motor capacities of 3,000 hp. or more requiring the handling of currents of 10,000 amp. or more is a difficult problem, and most constructions use contactors which are themselves energized from a master controller. While such a system operates satisfactorily, it lacks the highly desirable positiveness of a direct operation. That is to say, the engineer has no assurance that the contactors will always obey the impulses given from the master controller. It may also happen that one of the usually great number of contactors will stick, upsetting the entire control. It was found during tests that doubling and even trebling of each contactor reduced the current per finger but could not give the required positiveness. Moreover, it introduced a maze of additional connections. Further attempts were made with straight-row contacts and a traveling double brush, and later an auxiliary transformer connected in series with the main transformer came into use. Both designs failed to give the desired results, partly owing to arcing or on account of too heavy weight. Poege developed finally a system which, it is claimed, is both reliable and positive. He connects to the main transformer a regulator with stationary windings and a commutator upon which are arranged a set of brushes which can be shifted upon the circumference of the commutator.—*Elektrotechnik und Maschinenbau*, Jan. 28, 1923.

Points of Interest About the Capital Traction Company.—R. H. DALGLEISH.—A general idea of the physical characteristics of this property in Washington, D. C., is given, together with information on some of the company's construction and maintenance practices.—*Electric Railway Journal*, Feb. 10, 1923.

Heat Applications and Material Handling

Controllers for Ore Unloaders and Ore Bridges.—L. M. MORTENSEN.—The author discusses the different motor and controller connections used in conjunction with ore unloaders and ore bridges. The construction and principal characteristics of these machines as they vitally affect the equipment are briefly described.—*Proceedings of the Association of Iron and Steel Electrical Engineers*, February, 1923.

Arc Welding of Steel Structures.—F. P. MCKIBBEN.—Structural engineers are now giving careful attention to the application of electrical welding to steel structures with the view of guiding the art along safe lines. Up to the present time most electrically welded structures have not been carefully proportioned with proper regard for the stresses to be carried and the strength of parts necessary to carry them. The author gives also a short history of the erection of steel structures by this method, following it with examples of the problems encountered and the method by which these may be overcome.—*Journal of the American Welding Society*, February, 1923.

Telegraphy, Telephony, Radio and Signals

Oscillation Engineering Design of Submarine Acoustic Signaling Apparatus.—W. HAHNEMANN.—The acoustic systems corresponding to closed oscillatory electric circuits, to radiating electric systems and to coupled circuits are described. The design of submarine signaling transmitters and receivers on an engineering basis is also described and actual installations are discussed. The resemblance of submarine signaling engineering and radio engineering and the relation between these fields are considered. — *Proceedings of the Institute of Radio Engineers*, February, 1923.

Inverse Duplex System of Amplification.—B. PHELPS.—One of the best-known so-called reflex circuits is a hook-up whereby three amplifying tubes are used for three stages of radio and two of audio at the same time, employing a crystal for detection. The diagram for this circuit is given, accompanied with detailed data as to size of condensers and inductances to use.—*Q. S. T.*, March, 1923.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Colorado Ratifies Treaty

Six of the Seven States Watered by River Are Now in Line—Arizona May Reconsider

THE Colorado River treaty has been ratified by the Legislature of Colorado and was signed on Monday last by Governor Sweet. Only Arizona of the seven states concerned is now withholding its consent to the agreement. According to statements made by Colorado legislators, Arizona is to reconsider the decision made by her Legislature on March 10, when the bill for ratification was defeated by a tie vote. The treaty, however, could not become effective until its ratification by the new United States Congress, which, unless called in special session, will not meet until Dec. 4.

De Forest Demonstrates His "Phonofilm"

Before the New York Electrical Society on Wednesday evening of this week Dr. Lee de Forest gave a demonstration of his new "phonofilm," an invention to make voice reproduction with motion pictures practicable by inducing perfect synchronism. The process involves the photographing of sound vibrations on a standard motion-picture film and translation back to sound by electrical means. It was briefly described in the ELECTRICAL WORLD for Aug. 26, 1922, page 442.

"I claim," said Dr. de Forest, "that an entirely new form of screen drama can be worked out, taking advantage of the possibilities of introducing music and voice and appropriate acoustic effects, not necessarily throughout the entire action, but here and there where the effects can be much more startling, or theatrical, if you will, or significant, than is possible by pantomime alone, no matter how cleverly such can be worked out."

Connecticut Power Finances New Transmission Lines

The directors of the Connecticut Power Company last Monday authorized the floating of 7,500 shares of unissued common stock, with a par value of $100 a share. They will be offered to common-stock holders of record in the ratio of one share of new to two of old, stock not taken to be sold at par at the option of the directors.

The stock is to be sold to finance the projected transmission line to the north and a transmission circuit to New Britain. The former, as already told in the ELECTRICAL WORLD, is to extend from the South Meadow up the east bank of the Connecticut River to Springfield and then to Turners Falls, Mass. Right-of-way was obtained some time ago.

Public Utility Information Bureau for Pennsylvania

Representatives of all branches of the public utility companies of Pennsylvania met at the Bellevue-Stratford, Philadelphia, on Wednesday last, with Philip H. Gadsden, vice-president of the United Gas Improvement Company, as chairman, and virtually decided to establish a State Committee on Public Utility Information along the lines of those existing in many states. A committee composed of four members each from electric light and power, electric railway, telephone and gas companies was appointed to arrange for financing the new body and attend to the other preliminaries. Headquarters will probably be in Philadelphia.

Alabama Now Has Public Utility Bureau

A number of the leading public utility companies in Alabama last week established a joint information bureau in Birmingham in order to disseminate information regarding the utilities of the state. Leon C. Bradley, formerly city editor of the Birmingham *Age-Herald*, has been made director. Offices will be in the Jefferson County Bank building. The object of the bureau is to keep the people of the state informed at all times on fundamental questions affecting the utilities, according to J. S. Pevear, chairman.

In establishing the bureau, Mr. Pevear said, the utilities realize that the public utility industry has been more or less clouded with mystery and it is in an effort to correct this situation that the bureau has been formed. "It is our purpose," he said, "to conduct a bureau in which complete confidence can be placed, which will collect authoritative data on the industry and disseminate it impartially both to the public and to the utilities themselves. The object of the bureau is to acquaint the people of Alabama as thoroughly as possible with the facts, economic and otherwise, regarding the organizations which furnish them with electric light, power, gas, street-railway and other essential services."

Oppose Smith Power Bill

William Barclay Parsons and Others Point Out Its Weaknesses at Committee Hearing

ADVOCATES and opponents of Governor Smith's water-power bill clashed at a hearing on Wednesday, April 4, before the New York State Senate committee on conservation, and the usual countercharges of socialism and monopolistic greed were made.

George E. Van Kennen, Special Deputy Attorney-General, who drafted the measure, said it would affect only the St. Lawrence and Niagara Rivers and was intended to prevent a private monopoly of electricity in New York State such as the coal monopoly in Pennsylvania. He said that the bill was drawn in the best interests of the people of the state and that it would protect them from the companies which were now charging "exorbitant rates" for electricity.

William Barclay Parsons of New York City contended that such a law would be the means of killing private enterprise and that the bill really defeated itself, because no provision was made whereby power could be sold to electric railways.

Claims made by supporters of the measure that government development of hydro-electricity in Canada had resulted in cheaper rates for consumers were disputed by Frederick D. Corey, president of the Niagara, Lockport & Ontario Power Company.

Former Mayor Burns of Troy, representing the New York State Conference of Mayors, asserted that the bill was the result of the arrogance of water-power interests. If it became law, it could be used as a weapon to compel them to provide cheaper rates and better treatment to the consumers. The State Federation of Labor went on record in favor of the bill.

Senator Rabenold urged the power interests to help the state work out a plan for the economical development and distribution of hydro-electricity.

PUBLIC SERVICE COMMISSION BILL PASSES STATE SENATE

The bill to reorganize the New York Public Service Commission by substituting a commission of three members, removable by the Governor, for the present five commissioners, who can be removed only by a two-thirds vote of the Legislature, was passed by the New York State Senate on Wednesday and sent to the lower house. The Democrats control the Senate and the Republicans the Assembly.

Revision of Standards

A. I. E. E. Committee Making Good Progress—Twenty-seven Sections Under Tentative Preparation

THE standards committee of the American Institute of Electrical Engineers has undertaken a thorough revision of the A. I. E. E. standards. The work of revision is being carried out on the basis of certain principles as follows:

1. The standards will be subdivided into separate sections, each adequate to the needs of the machinery with which it deals.

2. There will be sections relating to general principles, technic of measurements and so forth.

3. Whenever practicable, the same general order of arrangement of the contents will be followed in each of the sections. This order of arrangement is as follows: Scope, service conditions, definitions, rating, heating limits, other limits to rating, efficiency, dielectric strength and insulation, resistance, regulation, variations in voltage, speed and frequency, construction details, etc.

The committee is preparing twenty-seven sections with the following titles:

1. General Principles Upon Which Heating Limits Are Based.
2. Standard Definitions and Symbols.
3. Standards for the Measurement of Test Voltages in Dielectric Strength Tests.
4. Standards for Direct-Current Generators and Motors and Direct-Current Commutator Machines in General.
5. Standards for Alternating-Current Synchronous Generators and Motors and Synchronous Machines in General.
6. Standards for Synchronous Converters.
7. Standards for Induction Motors and Asynchronous Machines in General.
8. Standards for Alternating-Current and Direct-Current Fractional-Horsepower Motors.
9. Standards for Railway Motors.
10. Standards for Prime Movers and Generator Units.
11. Standards for Power and Distributing Transformers.
12. Standards for Induction Regulators.
13. Standards for Instrument Transformers.
14. Standards for Control Apparatus.
15. Standards for Oil Circuit Breakers.
16. Standards for Air Circuit Breakers, Lever Switches, Inclosed Lever Switches and Disconnecting Switches.
17. Standards for Busbar Supports, Ammeter Jacks, Potential Plugs, Test Plugs, Power Fuses and Potential Transformer Fuses.
18. Standards for Switchboard Panels.
19. Standards for Lightning Arresters.
20. Standards for Electric Railways.
21. Standards for Wires and Cables.
22. Standards for Transmission Lines and Distribution Lines.
23. Standards for Meters and Instruments.
24. Standards for Telegraphy and Telephony.
25. Standards for Radio Communication.
26. Standards for Storage Batteries.
27. Standards for Illumination.

This division and the titles are not necessarily final and may be subject to modifications. It is the intention of the committee to concentrate on a few sections which, when completed, will serve as models for the others. These are:

3. Standards for the Measurement of Test Voltages in Dielectric Strength Tests.
4. Standards for Direct-Current Generators and Motors.
6. Standards for Synchronous Converters.
8. Standards for Alternating-Current and Direct-Current Fractional-Horsepower Motors.
11. Standards for Power and Distributing Transformers.
14. Standards for Control Apparatus.

The work is being carried on informally and suggestions are welcome from all who are interested. Each section will be approved by a representative working committee before being approved by the standards committee. It is proposed that before final adoption each section shall be printed or otherwise duplicated, and appropriate notice will appear in the *Journal of the A. I. E. E.* so that any one interested may obtain copies and contribute criticisms and suggestions.

PRELIMINARY DRAFT OF STANDARDS FOR CONTROL APPARATUS

It is expected that enough progress will have been made on the section of the proposed revision covering standards for control apparatus to permit its submission to the standards committee of the A. I. E. E. for approval at the meeting of the committee to be held about May 11. It is also expected that copies of the proposed standards will be available for distribution by April 16, and the standards committee requests that all interested engineers obtain copies by applying to the secretary of the Institute and give the committee the benefit of their criticisms and suggestions.

For Standardization in the Electrical Industry

For some time past there has been a growing feeling in the electrical field that the several electrical associations engaged in standardization work should co-operate in presenting a single set of electrical standards to the American Engineering Standards Committee for approval as American standards. The lack of universally accepted American standards has been a considerable handicap to this country in connection with international standardization and has undoubtedly increased the difficulty of selling electrical products in foreign countries.

During the summer of 1922 a movement was started to revise the A. I. E. E. standards, subdividing them into a number of separate pamphlets or sections, each covering completely the standards for one kind of apparatus. An outline of this work is printed on this page.

These two movements—one to revise the A. I. E. E. standards and the other to arrive at a single set of American standards through co-operative effort—were joined in a resolution adopted by the A. I. E. E. standards committee and approved by the A. I. E. E. board of directors last year.

Thus far standards for certain electrical machinery and apparatus only have reached a stage where the co-operative effort can take tangible form, and to deal with these the National Electric Light Association, the Electric Power Club, the Associated Manufacturers of Electrical Supplies and the American Institute of Electrical Engineers have appointed such official representatives. This joint committee has begun work and has had under consideration a section of standards for control apparatus. The first section, which is now in the hands of a representative working committee, will, as stated in the preceding article, be ready for circulation to all those interested within a brief period of time.

Electrical Men Welcome Sir J. J. Thomson

THE visit of Sir Joseph J. Thomson, master Trinity College, Cambridge, England, and a distinguished electrophysicist, has aroused great interest among the electrical men of America. The group picture shows a gathering at the works of the Metropolitan Engineering Company in Brooklyn, where Thomas E. Murray's method of welding glass to metal was inspected. Left to right, the men in the group are: J. B. Murray, vice-president Metropolitan Engineering Company; Thomas E. Murray, vice-president New York Edison Company; Sir J. J. Thomson; W. C. L. Eglin, vice-president Philadelphia Electric Company; Robert B. Owens, secretary Franklin Institute; John W. Lieb, vice-president New York Edison Company; John F. Murray, secretary Metropolitan Engineering Company; Thomas E. Murray, Jr., president Metropolitan Engineering Company, and Mr. Fields, a representative of the American Telephone & Telegraph Company.

Pacific Coast Technical Committees Meet

A final assembly of the sub-committees of the Technical Section of the Pacific Coast Electrical Association was held at Fresno, Cal., on March 20-22. Plans for the annual convention of the association, to be held in San Francisco on June 19-22, were the principal topic of discussion. It was decided to present two or three short papers on correlated subjects at the convention instead of submitting a printed report of the year's activity as in the past.

The chief interest of the three-day session just held centered in questions concerning three-phase versus single-phase distribution, 4,000-volt distribution, radio communication and automatic generating plants, and on all four of these topics informative discussions were held.

The hydraulic power committee reported that it had made a study of penstocks during the past year and had published its findings in a comprehensive report which will be presented by the national committee at the New York convention in June.

It has been decided to continue the work of the safety rules committee and the inductive co-ordination committee.

A meeting of the overhead-systems committee was held coincident with the meeting of the national committee in Chicago. The meeting was devoted largely to a discussion of the size and scope of the new handbook to be compiled by the committee. A resolution was passed favoring the adoption of 8½-in. x 11-in. sheets with standard loose-leaf punching so that the sheets may be filed in a loose-leaf binder of whatever description suits the individual.

Contractors Appoint a High Commissioner

Charles L. Eidlitz Chosen to Be the Judge Landis of the Electrical Contractors of New York City—He Will Seek to Reform Their Business Methods

EVER since 1914 the electrical contracting business of New York City has been on an unstable basis. The war brought with it more work than could be comfortably handled by existing firms, and in consequence inexperienced and irresponsible wiremen were attracted to the business and began to compete for contracts, to the demoralization of the entire electrical trade.

Conditions became worse instead of better after the war. Competition was bitter and keen; overhead expense was ignored, and jobs were taken for less than the cost of material and labor, complete reliance for profit being placed on changes and extras. Such a condition of affairs meant that the contractors were losing not only money but good will as well. Matters were finally brought to a head at a recent meeting of the electrical contractors' associations of Manhattan, Brooklyn and Queens Boroughs, when the following resolution was adopted:

"Whereas the business of electrical contracting has developed a speculative character to such an extent as to convert it from a profitable to an unprofitable business, partly owing to economic conditions and partly to the increase of the speculative hazards normally inherent in the business; and

"Whereas it is desirable to take such remedial measures as may suggest themselves by a careful survey of the situation,

"Therefore, be it resolved that Charles L. Eidlitz be and he hereby is appointed a commissioner of this association to make such studies in whatever manner deemed best by him in consultation with the executive committee and to develop therefrom for this association ways and means of transforming the business of electrical contracting from its present highly speculative character to a regular and profitable business, free from undue speculation."

CHARLES L. EIDLITZ

The aggregate business done by the electrical contractors in the metropolitan district ranges from $40,000,000 to $60,000,000 yearly. There are three hundred members in the associations. Mr. Eidlitz began his work of reorganizing contracting methods and eradicating bad trade practices among them on April 1. The first organization meeting was held in New York on Thursday.

EIDLITZ A CONTRACTOR AND ORGANIZER

The contractors of New York were moved to choose Mr. Eidlitz as their commissioner because of his long experience and standing in the industry. Mr. Eidlitz was born in New York on Sept. 3, 1866. As a boy he was one of the numerous youthful apprentices in the Edison Machine Works on Goerck Street, New York City. About two years after graduation from Columbia University in the class of 1888 Mr. Eidlitz organized the Charles L. Eidlitz Company, electrical contractors. The firm's affairs progressed successfully for more than twenty years, or until Mr. Eidlitz retired as president in 1913, bringing its operations to a close.

Though nominally in retirement, Mr. Eidlitz is a very busy man. He is president of the Metropolitan Electric Manufacturing Company, which he organized in 1902; president of the Atlantic Electric Goods Company and is interested less directly in several other enterprises. His influence has been strongly felt in the councils of his associates and of the electrical contracting profession at large, to which he has brought marked organizing and executive ability. He was one of the founders of the National Electrical Contractors' Association, serving as its first president from 1901 to 1903. He also established the Building Trades Employers' Association of New York City in 1903, of which he was president until 1905. Mr. Eidlitz is a member of the New York Electrical Society and the Building Trades Club and a founder member of the Edison Pioneers.

OBJECTS TO BE ACCOMPLISHED

When Mr. Eidlitz was seen in his office at 1170 Broadway by a representative of the ELECTRICAL WORLD this week, he told of the conditions in the electrical contracting business in New York City and its environs, the chaotic state of which caused him to be chosen to his new office. Mr. Eidlitz said that the job was not of his seeking, but because of his long connection with the electrical contracting business and his keen interest in its welfare he had accepted the position thrust upon him. The movement, he said, was instigated by the largest contracting firms in the business, all of which have pledged him their earnest co-operation and support.

Mr. Eidlitz will have authority to reorganize local contracting methods from top to bottom but without touching labor. The books and accounts of the various contracting firms will be open to him at all reasonable times. He is privileged to inspect them much as a bank examiner inspects the books of national and state banks. As indicative of the dearth of knowledge among even large firms on the cost of doing business, Mr. Eidlitz showed a tabulation of bids for a large building in the city. Although the specifications furnished bidders were the same, the estimates for labor alone ran $8,100, $11,000, $12,000, $13,500, $14,600, $16,800, $17,000 and $20,000, and the estimates for the conduit and other material were also at variance to almost the same degree. Mr. Eidlitz said this case was typical of bids for other installations and that it showed the necessity for education. To his amazement he had found that the painstaking work of the Association of Electragists International in its "Manual of Estimating" was either unknown or ignored in spite of the fact that it represented

the practice and experience of companies all through the country and was applicable to work anywhere, the unit basis being man-hours.

"The electrical contracting business in New York," he said, "has become completely demoralized. Some men are in it without real knowledge of the work, business training or financial responsibility. No real organization or reputation can stand up against competition of this kind. I have seen bids which when the cost of labor plus the cost of material was deducted would not even pay expenses, to say nothing of profit. So many changes and additions are made in electrical equipment during the course of constructing a building that contractors are tempted to put in figures for the original work at less than cost in the hope that the extra work will enable them to pull out with a profit. This makes a gambling game out of a legitimate business. There is no apparent reason why bids should vary from 20 to 140 per cent. Certainly the cost of labor should not vary on efficiency or supervision more than 10 per cent. If when bidding on contracts electrical contractors were informed that the contract carried with it no changes or extras, all such work being let to some other contractor, the bids would be entirely different.

"What I hope to do," Mr. Eidlitz went on, "is to educate the trade to a knowledge of how much of a certain kind of work a man can do. In this work I shall seek the active co-operation of the Association of Electragists International as well as the experience of the non-association contractors. Out of this work should evolve a manual for the electrical wireman which will be of immense value to him in his work and will educate him in proper business methods. The task which is before me has nothing whatsoever to do with price fixing, nor will it savor in the least of collusion. Whenever I am in doubt as to whether it is legal for me to go ahead on a certain line, I will ask the Attorney-General for a ruling."

Mr. Eidlitz's appointment and acceptance of the post of commissioner has been received very favorably by the electrical contractors of the city.

Substantial Increase in Utility Financing During March

DURING the month of March issues of stocks and bonds made by electric light and power companies totaled $95,172,750, the highest figure reached this year, exceeding the banner month of 1922 (October) by more than three million dollars. Only one offering exceeded ten million dollars, the fifteen-million-dollar-issue of the Duquesne Light Company, but thirty-two utilities took part in the month's financing. Although the refunding activity continued, a large number of issues were offered for the purpose of obtaining new capital to provide for additions and extensions. The rate of return yielded the investor advanced to 6.31 from 6.25 in February. Long-term issues prevailed.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN MARCH

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Consolidated Power & Light Co., (W. Va.)	$7,000,000	20	First mortgage and refunding lien sinking-fund gold bonds, series A	General corporate purposes	6½	99½	6.50
Southern California Edison Co.	10,000,000	21	General and refunding mortgage gold bonds	Construction	5½	97½	5.70
Pennsylvania Water & Power Co.	450,000	17	First mortgage sinking-fund bonds	Additions	5	98½	5.12
Portland Railway, Light & Power Co	1,000,000	..	Cumulative prior preferred stock, series A	To reimburse for construction	7	98	7.13
Puget Sound Power & Light Co.	2,000,000	..	Cumulative prior preference stock	Additions	7	103	6.80
Wisconsin Railway, Light & Power Co.	825,000	10	First mortgage and refunding gold bonds of 1913		5	89	6.50
American Power & Light Co.	5,000,000	93	Gold debenture bonds, American series	To retire floating debt and for working capital	6	95½	6.25
Duquesne Light Co.	15,000,000	..	First preferred stock, cumulative, series A	Refunding and for additions and extensions	7	103	6.80
Missouri Utilities Co.	600,000	29	First mortgage gold bonds, series A	Refunding and to reimburse for construction	6	96½	6.25
Penn Public Service Corp.	1,500,000	15	Convertible gold debentures	Acquisition of common stock of companies to be merged and for working capital	6½	98	6.70
Public Service Co. of Northern Ill.	5,000,000	39	First lien and refunding mortgage gold bonds, series A	Capital expenditures and to reimburse for retirement of maturing obligations and expenditures	5½	94½	5.88
Federal Light & Traction Co.	2,500,000	30	Convertible debenture gold bonds, series A	Refunding and to reimburse for expenditures	7	100	7
Georgia Railway & Power Co.	3,000,000	25	General mortgage gold bonds, series F		6	97	6.25
West Penn Power Co.	6,000,000	40	First mortgage gold bonds, series E	Additions and extensions	5	90	5.62
Hawkesbury Electric Light & Power Co., Ltd. (Ont.)	300,000	20	First mortgage bonds	Refunding and for additional working capital	6½	100	6.50
Interstate Electric Corp.	550,000	10	Sinking-fund gold debenture bonds	Refunding, additions and other purposes	7	98½	7.20
Los Angeles Gas & Electric Corp.	4,000,000	20	General and refunding mortgage gold bonds, series F	Additions and extensions	5½	97½	5.70
Metropolitan Edison Co.	1,000,000	30	First and refunding mortgage gold bonds, series C	To reimburse for capital expenditures	5	89	5.77
	1,176,000	..	Cumulative participating preferred stock	Acquisition of new stock and other purposes	7	98	7.14
Ohio Public Service Co.	2,675,000	30	First mortgage and refunding gold bonds, series C	Additions, refunding and other purposes	6	97.29	6.20
United Light & Railways	1,000,000	30	First lien and consolidated mortgage gold bonds, series A	To reimburse for additions and improvements	6	97	6.20
Arizona Power Co.	800,000	24	First lien and unifying mortgage gold bonds, series A	Refunding, to reimburse for additions and other purposes	6	97	6.20
General Gas & Electric Corp.	1,000,000	..	Cumulative preferred stock, class A	Additions and for other purposes	8	100	8
Illinois Electric Power Co.	3,500,000	20	First mortgage sinking-fund gold bonds, series A	Construction	6	97	6.25
Electrical Securities Corp. (N. Y.)	1,000,000	30	Collateral trust sinking-fund gold bonds, sixteenth series	New capital	5	94	5.40
Salina Light, Power & Gas Co.	950,000	20	First mortgage sinking-fund gold bonds, series A	Refunding and for additions and extensions	6	96.63	6.30
Wisconsin-Minnesota Light & Power Co.	323,750	..	Cumulative preferred stock	Additions and extensions	7	92½	7.57
American Water Works & Electric Co.	2,000,000	..	Cumulative first preferred stock (voting-trust certificates)	Corporate purposes	7	91 (flat)	7.75
Eastern Connecticut Power Co.	3,000,000	25	First mortgage sinking-fund gold bonds, series A	Extensions, purchase of securities and refunding	5	91	5.70
				To provide for future requirements	5	89½	5.80
Idaho Power Co.	3,200,000	24	First mortgage gold bonds of 1917	Refunding	6	96	6.30
Nevada-California Electric Corp.	1,500,000	27	First lien gold bonds, series B of 1920	Refunding and for cash working capital	6½	98	6.75
Standard Gas & Electric Co.	6,000,000	10	Convertible gold debenture bonds	Refunding and to reimburse for capital expenditures	6	100	6
Western United Gas & Electric Co.	1,323,000	27	General mortgage gold bonds				
Total	$95,172,750						

A. E. S. C. Year Book Out

Steady Progress Toward Standardization in Electrical Industries Is Indicated

GREAT progress the last year in standardization projects affecting electrical industries is shown by the 1923 Year Book of the American Engineering Standards Committee, which has just been issued. Of thirty-five standards thus far approved by the committee, eleven are of special interest to the electrical industries. Of these the National Electrical Code and Electrical Safety Code of course rank first, the others being the "Code for Electricity Meters," "Automobile Headlighting Specifications," "Code of Lighting Factories, Mills and Other Workplaces," "Safety Code for the Protection of the Heads and Eyes of Industrial Workers," "Illuminating Engineering Nomenclature and Photometric Standards," "Methods for Battery Assay of Copper," "Specifications for Electrolytic Copper Wire Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars," "Specifications for Lake Copper Wire Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars," and "Specifications for Soft or Annealed Copper Wire."

Of 121 projects which have reached an official status, fifteen have to do with electrical engineering. Two hundred and seventy-five national bodies—technical, industrial and governmental—are now co-operating in the work of the A. E. S. C. through officially accredited representatives, and more than nine hundred individuals are serving on the sectional committees which carry on the actual standardization work, the A. E. S. C. acting only as an administrative body.

ELECTRICAL REPRESENTATIVES

The electrical industry is represented on the committee by the American Institute of Electrical Engineers, the Association of Edison Illuminating Companies, the National Electric Light Association, the American Electric Railway Association, the Electrical Manufacturers' Council, the Associated Manufacturers of Electrical Supplies, the Electrical Manufacturers' Club and the Electric Power Club.

One of the most important accomplishments of the year was the development of a plan of co-operation between the Federal Specifications Board—the body which develops the specifications for all government purchases—and the A. E. S. C. by which the specifications of the board are submitted informally to the A. E. S. C. before definite adoption. Through this plan the government receives the criticisms of industry through the organizations which speak for those branches of industry that are concerned with any particular standard. Among the specifications which have already been submitted to the A. E. S. C. under this new co-operative arrangement are those for dry cells, snap switches, rigid conduits and rubber-insulated wires and cables. Dr. A. S. McAllister, who has been serving as a special liaison officer of the Bureau of Standards, has been designated by the chairman of the Federal Specifications Board as liaison representative in the co-operative work with the A. E. S. C.

Other electrical projects which have an official status before the committee are those for an electrical fire and safety code, a safety code for electrical power control, a safety code for lightning protection, terminal markings for electrical apparatus, rating of electrical machinery, insulated wires and cables (other than telephone and telegraph), symbols for electrical equipment of buildings and ships, electrical properties of aluminum, electrical installations on shipboard, a specification for 600-volt direct-current overhead-trolley construction, and electrical safety rules for bituminous coal mines.

Rural Power Districts Authorized in Michigan Bill

A bill now before the Michigan Legislature will, if passed, allow any township having a resident population of not less than 500 to establish rural power districts and by purchase or construction acquire facilities to transform, transmit and distribute electrical energy. Before such a district is established the township board must declare the expediency of the formation of such a district and obtain an estimate on the cost from some competent person, and the question of raising the necessary money shall be submitted to the electors at a regular or special election. It will take two-thirds of the electors voting at the election to pass the proposal. The township will then be authorized to borrow not to exceed 5 per cent of the assessed value of the property in the township for the purpose of establishing the power district. Bonds may be issued but shall not be sold below par, the interest shall not exceed 6 per cent, and the total amount expended must not exceed the estimate.

Authorization for maintenance is given to the board, which will have the right to contract with any public or private corporation for its energy supply. Construction of lines is to be in accord with the specifications prescribed by the Michigan Public Utilities Commission.

Delaware River Development Bill a Law in New York

The bill providing for the appointment by the Governor of New York of three commissioners to confer with commissioners named in New Jersey and Pennsylvania for the purpose of making a treaty between the three states and the federal government for the conservation, use and development of the water resources of the Delaware River is now a law in New York State. The sum of $10,000 is to be appropriated to pay the necessary expenses of the commissioners, who are to serve without compensation.

Rate Cut for Philadelphia

Consumers Will Save a Million a Year by Reductions in Residential and Other Charges

THE rate reduction made by the Philadelphia Electric Company a year ago, which the officials of the company say resulted in a saving to consumers of $1,200,000 in twelve months, has just been followed by another reduction which the officials say will bring a further saving to consumers in a similar period of $1,000,000.

The new rates will go into effect on May 1. Residence service will be charged for at the rate of 8 cents a kilowatt-hour for the first 36 kw.-hr. or less used during a three-month period, 7 cents for the next 144 kw.-hr. or less (a reduction from 225 kw.-hr.), and 5 cents for energy in excess of 180 kw.-hr. (a reduction from 261 kw.-hr.). Retail lighting service will be on an 8-cent, 6-cent and 4-cent basis as before but the number of hours' use in the three classes will be reduced respectively from 75 to 60, from 75 to 60, and from 150 to 120. For retail power service the same reductions in hours' use will be made, the rates remaining at 7½ cents, 5½ cents and 3½ cents. There will also be reductions in "standby" and "current" charges for wholesale light and power service (maximum demand) and "Rate E" power service, as well as kilowatt-hour reductions for auto-charging and for theater service.

Reductions in municipal lighting rates throughout the territory served by the company will bring about an annual saving of more than $80,000.

COMPANY EXPLAINS REDUCTIONS

W. H. Johnson, senior vice-president of the Philadelphia Electric Company, discussed the reductions as follows:

"The reduction in rates, expressed on a percentage basis, will vary in the different schedules from 2½ to 5 per cent, depending upon the class of service, and will amount, over all, to nearly $1,000,000. Customers who are obtaining service under schedules of our tariff in which a coal clause is incorporated will also receive the benefit of whatever lower coal costs we may obtain.

"When the reduction was made a year ago it was our expectation that business generally would take an upward turn and that the reduction in rates made by us at that time would act as a stimulus to such business expansion, which would be reflected in increase in our revenue. It is most gratifying to the management to have our predictions verified. It is pleasing that we are able this year to make a reduction in rates for street lighting to the cities and boroughs in our territory, even though our contracts with them at higher rates are valid for from one to five years. The reductions in rates during the last two years have only been made possible because of largely increased output in connection with increased efficiencies and the exercise of rigid economies in our operation."

Massachusetts Adopts Industrial Lighting Code

Effective Jan. 1, 1924, the Massachusetts Department of Labor and Industries has voted to establish a lighting code for industrial and mercantile establishments following the general lines of the New York code. As an initial set of regulations the code appears to be potentially effective in relation to flagrant abuses of illumination and furnishes a point of departure for later advances. Well-informed opinion, however, inclines to the view that the code leaves much to be desired in relation to the specification of intensities for textile mills and for machinery devoted to coarse operations. The code does not follow that of the American Engineering Standards Committee.

Indianapolis Contest Over Competition Comes Up

The Merchants' Heat & Light Company's injunction suit to restrain the Indiana Public Service Commission from issuing a certificate of necessity and convenience to the Terre Haute, Indianapolis & Eastern Traction Company was assailed March 28 in a demurrer filed by the commission. The commission recently demurred to a similar suit filed by the Indianapolis Light & Heat Company. A joint hearing on April 9 in the Superior Court has been ordered. Officials predict that the hearing on the demurrers will result in the cases being quashed. In answer to the charge that the local commercial electric field is congested, the demurrer declares that the Merchants' company is not operating under an exclusive franchise and is powerless to exclude competition. It further contends that the company's complaint fails to show that the Public Service Commission's order to the traction company is for rate-making purposes.

City officials of Richmond, Ind., have voiced disapproval of a contract submitted by the Terre Haute, Indianapolis & Eastern Traction Company asking for permission to run a high-power transmission line through the city to connect with the Dayton Light & Power Company east of Richmond. The company agrees not to compete with the municipal light plant in Richmond, but has refused, it is said by city officials there, to agree not to compete with the city light plant outside the corporation limits. Some of the big industrial consumers are outside the city limits, and the city officials fear the traction company will try to get this patronage if permitted to run its wires through the city.

Missouri Commission Gets Large Appropriation

The Missouri State Public Service Commission, which was the center of an eighteen-hour deadlock in the closing hours of the Legislature, came out of the fight with a larger appropriation than it had asked for and with more than it received for the last biennium. As finally passed this bill carried an appropriation from the revenue fund for the Public Service Commission of $125,000 and a like sum from the earnings of the commission if they run so high. This $250,000 with the $71,000 for the commission incorporated in the civil salaries bill gives the commission $321,000, though it had asked only for $318,000.

Illinois Power & Light Bond Issue of $30,000,000

Plans already reported (ELECTRICAL WORLD, March 10, page 591) for the consolidation and reorganization of the North American Light & Power Company and the Illinois Traction Company, whose combined interests include about ninety-five public utilities valued at $200,000,000, were approved at a meeting of the stockholders of the Illinois Traction Company on March 24th. A new company, to be called the Illinois Power & Light Corporation, was formed to absorb the light and power companies owned by the North American Light & Power Company, which served about forty towns in southern Illinois, as well as those owned by the Illinois Traction Company, which served about fifty-five towns in Illinois, Missouri, Kansas and Iowa. W. B. McKinley will be head of the merged corporations.

An issue of $30,000,000 first and refunding mortgage thirty-year 6 per cent bonds of the new company was offered on Monday at 98½, to yield 6.10 per cent. Proceeds from the sale and also from the sale of $10,000,000 of debenture bonds will be used toward the retirement of more than $50,000,000 securities of the companies formerly constituting the Illinois Traction Company system and also to acquire the properties formerly owned by the Southern Illinois Light & Power Company.

Floodlighting Little Rock's New Broadway Bridge

©Charles J. Griffith

THE floodlighting of the Broadway Bridge at Little Rock, Ark., thrown open on March 12, was the result of co-operation between the various branches of the electrical industry in Little Rock. The chairman of the Board of Commerce committee appointed a committee from the utilities of the city, which in turn invited the Electric Club, composed of the electrical contractors in the city as well as the utilities, to assist. The very effective result of the co-operation of these bodies is shown in the photo.

The length of the bridge, including approaches, is 2,873 ft. The floodlighting was financed by the utility companies of Little Rock and designed by the Little Rock Electric Club. Four batteries of floodlamps were used to illuminate the bridge during the celebration and four individual floodlamp units were spaced apart from the batteries. Each battery consisted of two 1,000-cp. and three 500-cp. floodlighting units. These batteries were placed about 100 ft. from the bridge on both sides of the river and on each side of the bridge. In order to bring out the center span, an additional floodlamp was installed about 250 ft. from the bridge on each side and on both sides of the river.

Brief News Notes

Wausau to Have Electrical Exposition.—Wausau, Wis., is to have an Electrical Exposition and Food Products Show on April 9-14 which its promoters claim will be one of the best ever held in a city of 20,000 people. Electrical interests operating in all parts of Wisconsin are to be represented.

Marshall, Okla., to Abandon Municipal Plant.—When the new transmission line of the Oklahoma Gas & Electric Company is completed the town of Marshall, Okla., will abandon its municipal electric light plant and receive service through the Enid division of that company.

Jim Falls Power Plant Completed.—The Chippewa Power Company announces the completion of the hydro-electric plant at Jim Falls, Wis., started last summer. It has a capacity of approximately 16,000 hp. and has been leased to the Wisconsin-Minnesota Light & Power Company, with whose Wissota hydro-electric plant near Eau Claire it is connected.

Another College in Line for a Metermen's Course.—The Kansas State Agricultural College will hold a metermen's short course from April 16 to April 21. Metermen of Kansas and surrounding states are being invited, and many of the larger cities with well-developed meter departments and expert metermen in charge will co-operate by sending their men to assist.

Electrical Progress at Memphis.—It will cost the Memphis Power & Light Company more than $3,000,000 to complete its new plant at Broadway, Fourth and Iowa Streets, President H. C. Abell announces. The amount will include the installing of boilers, turbines and other electrical apparatus. Construction is under way, and the company hopes to have the plant ready for operation by next fall.

Express Company Uses 1,500 Electric Trucks in Twenty-Seven Cities.—Twenty-five electric trucks for use in San Antonio, Tex., have been ordered by the American Railway Express Company, and all horse-drawn trucks will be discontinued. San Antonio is the twenty-seventh city in the country in which electric trucks of the American Railway Express Company are being used, bringing the total in use by this company to approximately 1,500.

Fishing for Sardines with Electricity.—Sardine canneries along the Norwegian coast, recently threatened with a complete lack of raw material owing to the fish remaining so deep as to render fishing impossible, have, it is said, solved the problem of bringing them to the surface by flashing electric searchlights over the water. According to a report received by the Department of Commerce from Consul George N. Ifft, Bergen, many shoals of the little fish previously safe from capture are being lured to the surface and into the cans.

Geary Goes on Oklahoma Gas & Electric's Lines.—The town of Geary, Okla., was cut in on the Oklahoma Gas & Electric Company's transmission line a week or two ago and the local municipal electric light and power plant was shut down, the seventh to close within recent months. The Geary line runs south from Watonga, 15 miles, and will be operated as a part of the Enid division.

Interconnection in North Central States.—Interconnection between the 40,000-volt lines of the Otter Tail Power Company, Fergus Falls, Minn., and the Union Light, Heat & Power Company, Fargo, N. D., has been completed and interchange of energy begun. This leaves a gap of only 12 miles between the generating stations on the Mississippi River in Minnesota and the largest city of North Dakota.

Meter School at Purdue.—The electric metermen of Indiana will meet at Purdue University for a five-day conference and school on April 9 to 13, under the auspices of the engineering extension service. A room has been set aside in the electrical engineering building where apparatus will be placed and cataloged so that the particular machine sought may be found at once. Experiments will be conducted on polyphase meter connections and the determination of instrument transmission errors.

Michigan Utility Increases Capacity.—By the addition of a 2,000-kw. General Electric turbo-generator and a 780-hp. Stirling boiler the capacity of the Citizens' Light & Power Company, Adrian, Mich., has been increased to 3,500 kw. This increased capacity was due, according to H. A. Fee, president, to the growing demand for both residential and industrial power. In 1919 the total kilowatt-hour sales were 2,298,913, while in 1922 they had risen to 3,001,389, with a value of $180,905.

Utility Education in Missouri High Schools.—Four thousand pupils in 228 of the 636 high schools in Missouri are studying public utility subjects. This has come about through the activities of the Missouri Committee on Public Utility Information, which, in noting the success of the work, suggests that since the bulletins supplied the schools deal largely with technical subjects, it would be wise for central-station operators to invite classes to visit their plants for personally conducted tours.

Map of Iowa's High-Tension Lines.—A map is being prepared by the Iowa Committee on Public Utility Information which will show the network of transmission lines now covering the state. Besides the high-tension transmission lines connecting the smaller towns, thousands of miles of lower-voltage rural lines will also be shown. Reports received by the committee indicate that a great number of rural lines will be built in Iowa this year. Ten years ago such a map would have shown only a few short scattering lines.

Middle West Utilities Increases Stock.—At the annual stockholders' meeting in Wilmington, Del., on March 27, both the prior-lien and the preferred stock of the Middle West Utilities Company were by charter amendment increased to $30,000,000 and the common stock to 300,000 shares of no par value.

Electric Vehicles for Post Office Service.—In the report of the joint congressional commission on postal service the enormous cost of repairs to motor vehicles is dwelt upon and doubt is cast on the economy of the government's maintaining its own equipment. The contract system, the commission asserts, should be tried out in representative cities. It adds: "It is, further, the opinion of the commission that electric vehicles should be experimented with in a typical city or group of cities to determine if economy would not be secured by their adoption in preference to the gas-propelled machine."

Leviathan to Have Biggest Radio.—The radio installation aboard the Leviathan, which will re-enter the transatlantic service in June flying the United States Lines flag, will, it is said by the Radio Corporation of America, which is making the installation, be the most powerful and elaborate steamship radio equipment in the world. In addition to telegraph service, a radio-telephone installation which will provide voice contact with other vessels and shore stations is to be installed. A special emergency set will also be put in. Furthermore, two of the lifeboats are to be fitted with emergency radio apparatus. The principal transmitter consists of a high-power vacuum-tube outfit which will deliver to main antonnas about six times as much power as the apparatus now used on the average steamship.

Electrical Control of Sperry Gyroscope.—A 350-hp. electric motor will drive the steel top weighing 100 tons and 13 ft. in diameter which Elmer A. Sperry has designed for the steamer Hawkeye State to prevent rolling and the consequent discomfort of the passengers. This gigantic top will run at 800 revolutions a minute in a huge metal case set in the hold of the vessel and so built that both case and top can incline to meet the motion of the ship. The top is electrically connected with a small gyroscope, which responds to the least roll and communicates its motion or swing to the 100-ton top. Answering the motion communicated electrically from the small gyroscope, the top swings first one way and then the other, and thus stops the roll of the vessel before it is well started, by acting as a counterbalance to the successive waves.

Northern States Power Reduces Coal 15 per Cent.—Improved operating economy at the fifteen steam-power plants of the Northern States Power Company in 1922 reduced the coal consumption per kilowatt-hour 15 per cent as compared with that consumed in 1921. This saving of 67,000 tons, valued at $400,000, was directly reflected in the earnings of the company. Steam-power

plants for the year generated 293,737,000 kw.-hr., or 35 per cent more than in 1921. The ten water-power plants totaled 139,878,000 kw.-hr., making a grand total of 433,615,000 kw.-hr. generated by the company's power plants. In addition, 54,330,000 kw.-hr. was purchased from other companies, making a total of 487,945,000 kw.-hr. placed at the disposal of the public in Minneapolis, St. Paul and nearly four hundred other cities, towns and villages in the Northwest in 1922.

Yale Scholarship for Mexican Engineering Students.—A Mexican scholarship in engineering at Yale has been endowed by John Hays Hammond. The award, which is for four years, will go to the student making the highest grade at examinations in Mexico City.

North American Company Buys Light & Development Company.—The North American Company has purchased the Light & Development Company of St. Louis. The North American Company owns the Union Electric Light & Power Company, and the Light & Development Company was a holding company operating several public utilities in and adjacent to St. Louis as well as numerous utilities in more distant points. This purchase foreshadows the probable amalgamation with the lines of the Union Electric Light & Power Company of properties in and around St. Louis which include the Cupples Station Light, Heat & Power Company in that city, the Western Power & Light Company in St. Louis County, an electric company in St. Charles, Mo., and one in Bonne Terre, Mo. The Light & Development Company owned and operated at points some distance from St. Louis the electric companies in Monmouth, Ill., Cape Girardeau, Poplar Bluffs and Carthage, Mo., and at points in other states.

Large Self-Cooled Transformers Ordered by Northern States Power Company.—In order to take care of increasing demand for power from industrial concerns and lighting requirements in and around Minneapolis, the Northern States Power Company has ordered from the Westinghouse Electric & Manufacturing Company three 15,000-kva. oil-immersed, self-colled single-phase transformers which, it is announced, are 50 per cent larger than the largest transformers of this type previously built. The three units used together in a bank will have a continuous capacity of 56,250 kva., or 75,000 hp. Each transformer will weigh approximately 150,000 lb., and the height to the tips of the high-voltage terminals will be nearly 25 ft. Approximately 7,000 gal. of highly refined oil is required for each unit. The high-tension winding of these transformers will be connected in star for 118,800 volts, the neutral of this star connection being solidly grounded, and the low-tension winding will be connected in delta for 15,405 volts. Inasmuch as the transformers are rated at 15,000 kva. with a temperature rise not to exceed 40 deg., they are equivalent to 18,750-kva., 55 deg.-rise transformers.

Associations and Societies

New York Section, A. I. E. E.—At the New York Section meeting next Wednesday, April 11, Dr. Robert A. Millikan of the California Institute of Technology, Pasadena, will speak on "Some of the Developments of Modern Physics."

Associated Engineering Societies Visit Wagner Plant.—On March 28 the Associated Engineering Societies of St. Louis were entertained by the Wagner Electric Corporation. A buffet supper was served and a motion picture showing the details of the design and construction of Wagner motors and transformers was taken. More than 400 engineers participated.

Society for the Promotion of Engineering Education.—The annual meeting of this society will be held at Ithaca, N. Y., on June 20, 21 and 22. Today (Saturday, April 7) the New England branch of the society is holding, in conjunction with the Associated Industries of Massachusetts, a meeting at Wentworth Institute, Boston, at which Prof. D. C. Jackson, Prof. C. F. Scott, Dr. Charles W. Eliot and other well-known men are to speak.

Innovation in Time of Section Meetings.—The New York Section, Illuminating Engineering Society, will try out the plan of holding meetings at 5:30 p.m. instead of later in the evening. This innovation will begin on Thursday, April 19, when "Hospital Lighting" will be the topic. A buffet luncheon will be served, and the idea is to "tie in" the meeting with the business day, permitting members and guests to be free by 8 o'clock. The new plan is reported to have been adopted in England with much success.

Middle Western Division, N. E. L. A.—The first annual convention of the Middle West Geographic Division of the National Electric Light Association, to be held at the Statler Hotel, St. Louis, next Wednesday and Thursday, will on the first day listen to addresses on public utility finances by Festus J. Wade, president of the Mercantile Trust Company of St. Louis, and on customer ownership of public utilities and securities by Louis H. Egan, president of the Union Electric Light & Power Company, and Dwight N. Lewis, president of the National Association of Railway and Utilities Commissioners. On Thursday E. W. Lloyd, chairman of the Joint Committee on Business Development, will talk on better business development; Martin J. Insull, vice-president Middle West Utilities Company, on public relations, and J. C. Martin, Western editor ELECTRICAL WORLD, on rural-line development. There will be a conference of public utility information directors on Tuesday. Among others who will address the convention are H. E. Weeks, treasurer People's Light Company, Davenport, Iowa, and H. C. Blackwell, vice-president and general manager Kansas City Power & Light Company. President Smith, Vice-president Davidson and Executive Manager Aylesworth of the National Electric Light Association will address the delegates at the banquet to be given at the Statler Hotel Wednesday evening.

Section Meetings, A. I. and S. E. E.—Coming section meetings of the Association of Iron and Steel Electrical Engineers are announced as follows: Chicago, April 11, "Electric Heating of Sheet-Mill Rolls," by Gordon Fox; Philadelphia, April 20, inspection of Bethlehem Steel Company's Lehigh and Saucon plants; Cleveland, April 9, "Teletype Communication in the Steel Mill," by J. O. Carr; Birmingham, April 21, "Interconnection of Industrial Power Plants with a Central System," by G. H. Finks; Pittsburgh, April 12, "Transient Phenomena and Their Elimination," by C. P. Steinmetz, and April 28, "Factors in the Selection of Mine-Hoist Motors," by F. W. Cramer and A. A. MacDonald.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Middle West Division, N. E. L. A.—St. Louis, April 11-12. H. M. Davis, Bankers' Life Bldg., Lincoln.

American Society of Mechanical Engineers—Pacific Coast meeting, Los Angeles, April 16-18; general convention, Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society — New York, April 24-27.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 13-15. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. Dean F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

Commission Rulings

Improper Capitalization.—In rate proceedings concerning the Sault Ste. Marie Gas & Electric Company the Michigan Public Utilities Commission refused to permit the issue of stock to capitalize a deficit resulting from the failure to earn a 7 per cent return on the rate base, or to capitalize reorganization expenses incurred several years before the application was made and prior to commission regulation, or to capitalize the expenses of a rate proceeding.

Evaluating Plant to Be Acquired by Municipality.—In placing a value on the McGowan Water, Light & Power Company prior to its sale to the town of Milton, the Wisconsin Railroad Commission held that consideration should be given to an investment in power-plant equipment discarded after connection with a transmission line, to past deficits, to land acquired after valuation proceedings were begun and to a well situated on private property and used as a water-supply source, provided that title was transferred to the municipality.

Exclusion of Record of Rate Fixing in One Borough Approved in Case Affecting Another Served by Same Utility.—In a rate hearing affecting the borough of Conneautville the Pennsylvania Public Service Commission excluded records of a similar hearing affecting the borough of Albion which were offered by the United Lighting Company, serving both boroughs, on the plea of the former borough that it had not been a party to the previous proceeding. The commission found that the allocation of property between the two boroughs was not vital or material.

Street-Lighting Rates — Interstate Business—Uniform Accounts.—Establishing new rates for the Pembina Light & Power Company, the North Dakota Board of Railroad Commissioners asserted that a municipality should bear its proportionate share of the expense of maintaining an electric utility by paying adequate rates for street lighting, although as a large consumer it may be entitled to slightly reduced rates, the expense of billing and meter reading being less. Street-lighting rates should be put on a meter basis (Pembina and other towns had been paying a flat rate less than the cost of service). The Pembina company serves St. Vincent, Minn., and exports energy to two towns in Manitoba, Canada, and the commission fixed rates upon the assumption that towns served outside the state will be required to meet their portion of a necessary increase in revenue to meet operating expenses, depreciation and return. The bookkeeping system of the Pembina company was disapproved, and it was ordered to use the uniform system of accounting prescribed by the commission.

Interest During Construction.—The Maine Public Utilities Commission refused to allow the Central Maine Power Company to issue stock for the capitalization of interest accruing on the cost of dam sites purchased for future development. The commission contended that the company might later sell some or all of these properties, in which case it would have capitalized as "interest during construction" an item properly chargeable to investment account. When actual construction begins a change in the classification of the item might be sanctioned.

Jurisdiction Over Mortgages.—Asserting its jurisdiction (*in re* Wisconsin Utilities Company) over the giving of a mortgage on public utility property within the state, the Wisconsin Railroad Commission refused an application for permission to issue a mortgage covering the property of a Wisconsin utility in order to secure bonds of a foreign holding corporation on the ground that this would establish a precedent against public policy contrary to the clear intent of the stock and bond law and might create a condition under which the commission would be deprived of its entire jurisdiction over the regulation of the issuance of securities by a Wisconsin corporation.

Should Pole Treatment Be Charged to Capital or Maintenance?—The Public Utilities Commission of Idaho in a case affecting the Kootenai Power Company held that the cost of treating poles might be properly charged to capital rather than to maintenance. "If a pole has been put through a process which lengthens its service life to nearly double what it would have been without such process, it would appear," the commission observed, "that the cost of the application of the process should be added to the cost of the natural poles as an element to be considered in determining the value of the pole. The service life of the pole is a determining factor in estimating the percentage rate for depreciation allowance."

Accuracy of Meter Service Accepted.—One A. D. Sharp complained to the Massachusetts Department of Public Utilities that he had been charged $84 for electric service covering a period during which, as compared with similar periods, he should not have been charged more than $23. The complainant produced evidence in support of his contention, but the department, while holding that as a matter of business judgment the company might have been justified in making a rebate, maintained its belief in the accuracy of the meter records of the electrical energy delivered to the premises and took the view that either there must have been a leak in the interior installation, for which the company was not responsible, or that the amount consumed must for some reason have been far greater than the petitioner's calculations indicated. The petition was therefore dismissed.

Original and Reproduction Cost.—The New York Public Service Commission, according with the practice of other bodies, does not accept original cost as the sole criterion of the value of a utility. In appraising the property of the Adirondack Power & Light Corporation the commission made this observation: "Fairness to the property, to its owners and to its consumers does seem to require recognition of pre-war cost of the present properties increased so far as to regard what seem to be reasonably permanent present-day prices of such properties constructed under existing conditions, and including overhead costs which are reasonable and necessary to be incurred, together with a provision for organization covering what may be said to be preliminary to putting up the plant."

Recent Court Decisions

Insulation by Isolation.—The trial judge having instructed the jury in Godfrey vs. Kansas City Light & Power Company that an electric wire by contact with which a boy was killed could have been isolated, the Kansas City Court of Appeals held the charge not to have been an error, despite evidence that there was no covering that could have been put on the wires, because a witness for the defendant included isolation within the term "insulation" and said that insulation by space is one of the best insulators known to the electrical world. "This evidence is not contradicted," the Court of Appeals said. "The record is undisputed that this wire could have been insulated by isolation, and in view of this testimony we do not think that the assumption in the instruction that the wire could have been insulated was improper." (247 S. W. 451.)*

Temporary Injunction Granted Against Increase of Contract Rates.—The Supreme Court of South Dakota held, upon a demurrer by the Mitchell Power Company against a motion by the city of Mitchell for a temporary injunction to restrain the company from charging rates in excess of those specified in its franchise and from discontinuing its service, that while the city and the company were powerless to make an irrevocable contract as to rates, yet the rate specified in the franchise, in the absence of negative allegations, will be presumed to be a reasonable rate for the purpose of considering the sufficiency of a complaint on demurrer, and on a hearing of a motion for a temporary injunction a like force will be given to such specified rate, in the absence of affidavits tending to show that it is unreasonable. (190 N. W. 1013.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

H. L. Geisse President Wisconsin Association

Harold L. Geisse, who was elected president of the Wisconsin Utilities Association at its recent convention in Milwaukee, is the secretary and general manager of the Wisconsin Valley Electric Company at Wausau, Wis. After his graduation from the University of Wisconsin in 1907 he served as statistician with the Railroad Commission of Wisconsin for one year and then joined the San Antonio Gas, Electric & Traction Company in Texas. But upon returning to Wisconsin in 1913 Mr. Geisse re-entered the employ of the Railroad Commission as statistician and subsequently was promoted to be assistant secretary and finally secretary. In the spring of 1919 he became associated with the Northwest Utilities Company, an Insull property, and later operated the Janesville Electric Company. Mr. Geisse remained with this organization until August, 1921, when he took charge of the Wisconsin Valley Electric Company.

H. L. GEISSE

Bruno Rahn of the Milwaukee Gas Light Company was elected vice-president of the Wisconsin Utilities Association and John N. Cadby of Madison was re-elected executive secretary. George A. Mills, general superintendent of the Wisconsin-Minnesota Light & Power Company at Eau Claire, Wis., in charge of construction and operation, is the new chairman of the Electric Section of the association.

T. C. Martin, past-president of the American Institute of Electrical Engineers and executive secretary of the National Electric Light Association for a number of years, has just returned from Europe after a short sojourn abroad.

F. M. Feiker to Direct Surveys at Washington

F. M. Feiker, assistant to the president of the McGraw-Hill Company, Inc., has, at the request of Secretary Hoover of the Department of Commerce, again received leave of absence to undertake the organization and general direction of the world surveys of raw-material supplies, rubber, sisal, hemp and nitrates, for which Congress made an emergency appropriation of $500,000.

Mr. Feiker served as assistant to the Secretary of Commerce during the first year of Mr. Hoover's administration, acting as general assistant in organizing the personnel and industrial trade contact committees in relation to the Bureau of Census, the Bureau of Standards and the Bureau of Foreign and Domestic Commerce. Out of his nine months' work came the monthly statistical survey of the Bureau of Census, the Division of Simplified Practice of the Bureau of Standards, *Commerce Reports* in new form and fifteen so-called commodity divisions of the Bureau of Foreign and Domestic Commerce. Of this latter work the annual report of Dr. Julius Klein, director of the Bureau of Foreign and Domestic Commerce, said: "The important task of carrying on this liaison work with the industries was under the general supervision of F. M. Feiker, assistant to the Secretary of Commerce. Mr. Feiker's extensive experience and wide contact with industrial organization and individual manufacturers are largely responsible for the striking success which has accompanied this innovation in the organization of a government department."

Elihu Thomson Honored on His Seventieth Birthday

Congratulations by wire, mail and spoken word poured in upon Dr. Elihu Thomson, consulting engineer General Electric Company, on Thursday of last week, when that beloved leader of electrical development attained the age of seventy. A celebration dinner was held at the Boston City Club, which was attended by about seventy-five friends and associates. W. C. Fish, former manager of the Lynn works of the company, was toastmaster. Vice-president G. E. Emmons, Schenectady, presented the guest of honor with a loving cup, and congratulations by letter were received from Thomas A. Edison, Dr. Charles P. Steinmetz, President Gerard Swope of the General Electric Company, O. D. Young, chairman board of directors, and President S. W. Stratton of the Massachusetts Institute of Technology. E. W. Rice, Jr., and W. R. Whitney cabled good wishes from Europe, and among the speakers who lauded Professor Thomson's achievements in the field of invention and research were Dr. A. E. Kennelly of Harvard University, Prof. D. C. Jackson of the Massachusetts Institute of Technology, Prof. C. A. Adams of Harvard University, J. R. Lovejoy, vice-president General Electric Company; G. Faccioli, electrical engineer at the Pittsfield works, and M. de Marjorie of the French Academy.

C. O'B. Murphy General Manager of Indiana Company

Charles O'Brien Murphy has recently been elected vice-president and general manager of the Central Indiana Power Company. Before engaging in the public utility business Mr. Murphy spent twelve years in Wall Street with W. H. Granbery & Company, Street & Norton and E. Clarence Jones & Company, all members of the New York Stock Exchange. During that time he became familiar with corporation securities and financing, leaving Wall Street as office manager for E. Clarence Jones & Company, specialists in bonds. Subsequently Mr. Murphy went West, where he became interested in public utility work. As vice-president and general manager of the United Light & Power Company and its subsidiaries, supplying electric light and power in and around San Francisco Bay, he helped to install central-station steam heating in San Francisco. When the Great Western Power Company of California took over the United in 1916 Mr. Murphy was retained in an executive capacity. In 1917 he became affiliated with the American Public Utilities Company of Grand Rapids, Mich., as assistant general manager, and one year later he joined the Merchants' Heat & Light Company, one of the properties forming the Central Indiana Power Company, as vice-president and general manager.

C. O'B. MURPHY

Sir J. J. Thomson Arrives

Sir Joseph J. Thomson, British physicist, who arrived in New York Monday, March 26, on board the Majestic, delivered the principal address at the meeting of the American Chemical Society in New Haven Wednesday night, April 4, selecting for his subject "The Unity of Physics and Chemistry." Sir Joseph will give a course of lectures before the Franklin Institute, Philadelphia, on April 9 to 14. Shortly after his arrival he was the guest of the Western Electric Company at a luncheon at its Bell System laboratories attended by F. B. Jewett, vice-president, in charge of the telephone department of the Western Electric Company; E. B. Craft, chief engineer; E. H. Colpitts, assistant chief engineer, and other company executives. After luncheon the party was escorted through the research plant.

Sir Joseph J. Thomson received the Nobel prize for physics in 1906. He was Cavendish professor in experimental physics in the University of Cambridge from 1884 until his resignation in 1918. During this time he developed a great research laboratory which attracted workers from all parts of the world. In 1918 he was elevated to the mastership of Trinity College, Cambridge, and in 1919 was elected to a newly established professorship of physics in the Cavendish Laboratory. He has been the recipient of many British and foreign awards and honors, is the author of treatises and textbooks on physics and is popularly known as the discoverer of the electron.

Col. Charles Keller Resigns

Col. Charles Keller, a widely known officer of the Corps of Engineers, U. S. A., who has served for the past two years as engineer commissioner of the District of Columbia, has resigned as a district commissioner to undertake important duties in connection with hydro-electric development on the Pacific Coast. Colonel Keller was not communicative regarding his new duties, but it is understood that he has been employed by the Eldorado Power Company, a subsidiary of the Western States Gas & Electric Company, to undertake the direction of the engineering work on the South Fork of the American River. The development planned at that point is confronted with engineering difficulties of unusual magnitude. Throughout his engineering career, which began with his graduation from West Point in 1890, Colonel Keller has taken great interest in water-power development. As the representative of the War Department he supervised most of the important installations at Niagara Falls, and he was the representative of the department who assisted in drafting the federal water-power act.

Fred H. Smith has been elected vice-president of the Worcester (Mass.) Electric Light Company. Mr. Smith is one of the best known central-station men in New England, having been assistant general manager of the Worcester company for about ten years and prior to that its electrical engineer. He is a past-chairman of the Commercial Section of the New England Division, N. E. L. A. He will continue the work of assistant general manager in his new post.

D. W. Snyder Heads Illinois Electric Association

D. W. Snyder, the new president of the Illinois State Electric Association, has been general manager of the Bloomington & Normal Railway & Light Company since 1917. After his graduation from Lafayette College in 1907 with an E.E. degree he entered the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company. The year 1909 was spent in construction work, and one year later he joined

D. W. Snyder

the Northampton Traction Company, Easton, Pa., as superintendent. From 1911 to 1914 he served as manager of the Clinton Gas & Electric Company, Clinton, Ill., and in 1915 he became connected as general superintendent with the Jefferson City Light & Power Company. Subsequently he was appointed to the position he now holds in Bloomington, Ill. Mr. Snyder has been an active member in the association's work, having for the past three years served as chairman of the rural-lines committee and as vice-president in 1922. He is also a member of the N. E. L. A. rural-lines committee.

Obituary

Charles F. Cuno, president of the Cuno Engineering Corporation, manufacturer of electric starting devices for automobiles, Meriden, Conn., died at Miami, Fla., March 14, at the age of sixty years.

George H. Guy, for the last forty years secretary of the New York Electrical Society, died of pneumonia on April 1 at the Long Island College Hospital. Mr. Guy was one of the leading spirits among those who obtained from Andrew Carnegie the gift of $1,500,000 from which sprang Engineering Societies Building and the Engineers' Club in New York City. He conducted a scientific press bureau for many years and was a contributor to the columns of the *Evening Post* and the *Globe*. Mr. Guy was a member of the A. I. E. E. and the Engineers' Club. He was seventy-six years old.

Major Abram J. Gifford, formerly in charge of the transportation department of the General Electric Company for many years, died March 20 at his home in Schenectady after an operation. He was seventy-four years old. In 1891 Major Gifford became associated with the Northeast Thomson-Houston Company at St. Paul, whence he was transferred in 1894 to the transportation department of the General Electric Company at Chicago. In 1899 he was put in charge of the transportation interests of the company and moved to Schenectady, where he resided until the time of his death. On March 1, 1920, he gave up his active duties, but continued on in an advisory capacity.

Philip I. Robinson, who was appointed manager of the Baton Rouge (La.) Electric Company recently, died on March 22 after a short illness. Mr. Robinson entered the statistics department of Stone & Webster, Inc., Boston, in 1908 and was soon transferred to Houghton, Mich., where he advanced to the post of superintendent of lighting for the Houghton County Electric Light Company in 1917. For about five years he was manager of the Fort Madison (Iowa) Electric Company and Dallas City (Tex.) Electric Company. Mr. Robinson was born in 1886, his home being at Waterville, Me., and was graduated in electrical engineering from the University of Maine in 1906.

Dr. Walter Gill Wylie, for many years intimately associated with water-power development in the South, died at his home in New York City on March 13 at the age of seventy-five years. Dr. Wylie was born in Chester, S. C., and besides being a surgeon of note was the first president of the Southern Power Company of Charlotte, N. C. He helped to organize the Anderson (S.C.) Water, Light & Power Company and later the Catawba Power Company. Early in 1900 he interested J. B. Duke, the tobacco magnate, in the water-power possibilities of the Carolinas, and shortly afterward the Southern Power Company, which has since grown to be the dominant power company of the South, was formed with Dr. Wylie as its head. Professional work in New York caused him later to relinquish the presidency to J. B. Duke, but his interest in industrial and power development continued unabated. Dr. Wylie was consulting surgeon of Bellevue Hospital and professor emeritus of the New York Polytechnic school of medicine for post-graduates. Besides being a member of numerous professional bodies he was a member of the Engineers' Club of New York, next door to which he lived.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Logical Outlet and Profit

Urges Careful Analysis of Market—If Jobber Is to Sell 9 per Cent of Output, Is He to Receive 9 per Cent of Support?

By W. A. Kennedy
Sales Manager Sibley-Pitman Electric Corporation, New York City

NATIONAL manufacturers have asked me to give them a recipe for success in electrical merchandising. I am quite willing to give it to them. There ought not to be anything confidential about it. It is a very old recipe — "character and knowledge." Getting business "any old way" is not an evidence of either character or knowledge. Business taken on the wrong basis today—even at a profit of $1,000—may seriously retard a manufacturer's progress for a year, with a failure to gain a possible profit of $30,000 tomorrow.

A manufacturer must have knowledge of his market—not casual knowledge, but a student's analytical knowledge. In applying his knowledge in the establishment of his policy he must have character — character enough to resist temptation, character enough to keep his head and push on, character enough to keep swimming up stream with a bone in his mouth, holding to the substance and ignoring the shadow.

The electrical industry is spending a considerable part of its time discussing the relative merits of electrical contractor-dealers, factory stores or department stores and where the jobber fits in with the ethics and profit—or loss—of canvassing for sales. In the electrical industry we are simply selling appliances on a pure basis of hit or miss. The manufacturer, the jobber and the retailer in virtually every city are working entirely in the dark so far as definite knowledge of the local market is concerned and knowledge as to how much they ought to spend and what they ought to do to develop. They do not know what the market really is. They do not analyze it from the standpoint of potential sales.

Suppose a manufacturer should decide to enter the New York City market with a campaign on vacuum cleaners. Here is a city of nearly six million inhabitants and a suburban territory within 50 miles having a total population of slightly under

W. A. Kennedy

five million. The usual way is to break loose with advertising, send out salesmen, set up jobbers or dealers, and then see how much business can be obtained, without determining in advance any single fact but that the people are there and therefore the market must be there.

It would be easily possible, however, to develop the facts from existing and accurate tables on wired homes, central-station customers, location of population, etc. From such accurate analysis the manufacturer would find that there are, for illustration, 750,000 wired homes within the metropolitan and suburban area that may be considered "prospects" to which the vacuum cleaner may be sold in advertising. If this manufacturer were to come to me in a spirit of analytical and intelligent co-operation, we could determine that there are 450,000 possible purchasers, and the manufacturer, considering all elements of sales resistance as well as sales potentialities, could definitely determine the number of machines which he could apportion to his territory. If his total output is to be 100,000 cleaners and he feels that he can assign 9,000 to the New York territory, then that means that I am called upon to do a 2 per cent job. I must sell 2 per cent of the apparent "prospects." That is all, but how many times has any manufacturer ever looked upon such an equation?

Since I am to sell 9 per cent of the manufacturer's output, it is not unreasonable for me to expect 9 per cent of his advertising and sales appropriations to be spent in furthering the New York campaign. If his appropriation for promotion is, for illustration, $100,000, then I am entitled to $9,000 less that proportion of the cost of national publicity represented by its circulation and value within my territory.

Importance of Advertising

No sensible jobber is apt to minimize the importance and value of national advertising. Such jobbers are aware that national reputations are made this way. An intelligent manufacturer could clearly show to any jobber how much of the national advertising is going into any particular local territory. The figures are always available. The proportion that the local jobber is receiving from a national campaign therefore can be figured out for him, but the allowance for local advertising should be in proportion to the job which the manufacturer expects him to do.

Such an arrangement cannot be one-sided. If the manufacturer is devoting 9 per cent of his sales promotion appropriation to a local campaign in which the jobber is expected to do a 2 per cent selling job, he should be willing to add to the manufacturer's appropriation an amount of money represented by the difference between the gross profit and operating expense up to a figure equal to the manufacturer's expenditure. Figuring this difference to be $3 per machine upon vacuum clean-

ers, the jobber should contribute $9,000, or net profit on the first 3,000 machines, the remaining 6,000 producing a net profit of $18,000. Whenever such fundamental principles are followed, we shall be able to do not merely a 2 per cent selling job, but a real job. On such a basis the jobber and the manufacturer combine their publicity and selling effort, and both enjoy the profit.

A campaign of this kind, predicated on accurate knowledge of the opportunity, a definite purpose in the undertaking and a clear understanding of the obligation on both sides, will put the selling of electrical merchandise on a plane that will be both profitable and constructive. The usual methods are tremendously wasteful. The manufacturer thinks in generalities, and his salesmen talk in generalities. The sales policy, if they have one, is framed at the factory with little or no regard for local market conditions. They don't know how many homes are wired in a town. They don't know how many people own their own homes. They don't know what they should or must spend to get the business. They don't know the source of the business when it comes. The scope of central-station companies serving the community is seldom if ever known. The average salesman is content to merely ask "Why don't you place an order? So-and-so has already done so."

Little headway will be made by any manufacturer in trying to determine on a purely theoretical basis how electrical appliances can best be sold—whether by establishing stores of his own, or through department stores, or through central stations, or through still some other channel. Every now and then you hear some manufacturer say that the electrical contractor-dealer is not a good merchant.

But let us consider for a moment whether or not there is a logical outlet, and, admitting that there is, my opinion is that it is within the electrical industry, and that it is based upon electrical contractor-dealers working in harmony and co-operation with the central-station companies

There has been a tendency on the part of some central stations to minimize the value of jobber to contractor-dealer distribution, and were the forces of the central stations and the contractor-dealers harnessed together properly, the question of logical outlet would be solved.

Central stations through their display rooms can select and direct the consumer in the use of appliances of approved merit, and with their facilities for making collections they can perform both sound and economical functions for the industry and by so doing obtain the support and interest of jobbers in the distribution of approved appliances, because in the final outcome the consumer looks to the central station for satisfactory service during the life of the appliance.

TAKING THE JOBBERS' PROFITS

Such a result, however, is retarded when any central-station company, in consideration of the volume of its purchases, obtains the jobbers' cost from the manufacturer and, because it is not performing any wholesale functions, passes along the compensation to the consumer. It would seem fundamental to me that when central stations recognize wholesale consumers of energy, who in turn distribute the energy to retail consumers, they should recognize without argument that the jobber is rightfully entitled to a wholesale profit, which is necessary to compensate for the labor and expense of service given retail dealers.

While the channel of distribution is important—and I believe it exists within the electrical trade—it is not nearly so important as the analysis of the market, the making of a definite policy and then sticking to it. Sound sales volume is not built overnight. What we want in electrical merchandising campaigns is more advance knowledge, more planning and more purpose—in other words, "character and knowledge."

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

FEAR of inflation following the unusually heavy purchasing during these last few weeks is causing considerable comment among the leaders of the larger manufacturers of the industry, and methods of curbing "dangerous buying" have already been adopted in different sections of the country where credit risks are being carefully scrutinized. In addition, a few bulletins warning against overloading the markets have been issued, but it is felt that this practice will not be widely followed by any sensible manufacturers who have already been through any one or two periods of inflation and who must well realize now that it is better to scrutinize accounts than to disregard and discourage them. Prices in the raw-material markets continue to go higher, and while copper has recovered about 45 per cent from the low levels of August, 1921, it is believed that still higher prices will come before the present boom has ended. Authorities in copper circles believe that the peak levels will not be reached for some time and that quotations will react sooner than will other commodities, as the red metal fluctuates most easily. Other advances in the porcelain, wire and iron-pipe markets are laid to general business conditions and up to the present time have been accepted by the larger manufacturers quite readily.

British Competition and Her Effort to Keep Skilled Labor

ALARMED by the loss of skilled workmen in the United States, Great Britain is taking determined steps to stem that type of emigration. This is thought to account for the recent very low prices which British manufacturers of electrical and other machinery have quoted on export bids. British manufacturers recently were able to underbid their American competitors for large orders in Canada and Brazil, at figures which indicate that little margin was left above the bare cost of labor and materials. At the same time, steps are being taken to increase the volume of domestic business in the hope that the earnings of skilled workmen will be sufficiently attractive to keep them at home. British manufacturers apparently are having some difficulties in their relation with the public at home. There seems to be a widespread feeling that the domestic market has been exploited so as to make possible sales at much lower prices in order to extend foreign trade. Domestic prices on electrical equipment have been such as to permit material inroads into the home market by German manufacturers. Now that they are faced with the departure for America of many of their skilled operatives, they are having difficulty in placating a rather hostile public.

Americans Do Not Expect to Get Europe's Larger Equipment Orders

THE extension of railway electrification now being undertaken in several of the European countries is not expected to bring orders to this country for the larger equipment needed, according to manufacturers in this country, but it is certain that some of the high-voltage equipment and supplies will be bought here. Also there will be purchases of American specialties, such as signal devices, switches and train-dispatching telephones.

The rising standards of living in China, Japan and India offer an improving market for American electrical specialties. The Oriental is particularly inclined to purchase anything novel. At present the United States is not getting the proportion of this business that it might expect owing to the fact that it has such poor selling facilities in those countries.

The drought during the past season has made it clear to the new hydroelectric companies in Japan that they must install steam auxiliaries. It is believed that the Japanese will soon be in the market extensively for much steam-plant equipment. The demand for power in that country is increasing by leaps and bounds to a point where there is a much greater demand for heavy loads throughout the entire year. The Japanese rivers are short and the opportunities for storage are few. As a result, the opportunity for equalizing the flow of their power streams is much less than in most other countries.

Occupation of Ruhr Affecting Demand for American Supplies

OCCUPATION of the Ruhr by the French and the cutting off of coal supplies from certain of the German plants engaged in manufacture of electrical goods is having a noticeable effect on the demand for American electrical goods abroad. The average order now reaching the American electrical manufacturers and jobbers is much larger than it was even three months ago. This is taken to indicate that the unsettling influence of low German bids has now been removed.

Meter Sales Are in Large Volume with Improved Deliveries

DELIVERY conditions in the meter market are highly satisfactory at present as regards the more common sizes and types of watt-hour instruments, looking at the current large demand from the angle of factory production and shipments. A few weeks ag it was reported that central-station buyers of meters would be wise to look farther ahead in placing orders. At that time rail embargoes and blockaded highways in the North were hampering transportation of both raw and finished materials so badly that there was at least a possibility of inconvenience in the supply of meters if the development of the building industry continued apace. Conditions have now improved materially on the road, and the larger manufacturers of meters have accumulated reasonable stocks of materials and are able to make prompt deliveries of standard lines either from the factory direct or out of district office stocks. The demand is very active, although perhaps a little below the 1920 peak. Overseas trade is poor and is handicapped by Continental competition. There is some tendency toward the more general use of 10-amp. meters in residential service as the number of appliances in use in the home multiplies, but the well-known overload capacity of the 5-amp. meter stands in the way of any very rapid change here. Industries and utilities are using more graphic equipment. Labor is in fair supply in meter factories, and women are extensively employed in this field. Prices are steady, with little tendency toward fluctuation.

Farm-Lighting Sets About to Enjoy More Active Market

RESTRICTIONS upon travel in rural districts in the northern sections have impaired the growth of farm-lighting business in some quarters, although the total volume of trade is probably somewhat ahead of last year's. A slow opening up of this field is anticipated, followed by a good year's business, reaching its peak in the summer or fall. Little trouble is expected from low stocks in the larger distribution depots, for it has been the practice in the more progressive of these organization branches to carry stocks capable of meeting a demand considerably in excess of the present volume. Some manufacturers have stiffened their prices to at least a moderate degree as a result of increased production costs, but not all have done this as yet. The outlook is for a general falling into line on price movement before long if present labor and material costs do not come to a halt or decrease. One large manufacturer is still selling on a 1917 price basis and has made no change of importance in five months. Confidence as to the outlook is widespread.

Irregular Demand for Tools Due to Accumulated Stocks

OWING to the previous accumulation of considerable stocks by distributors, the demand for electric tools as felt by representative manufacturing interests is at present somewhat uneven from week to week, although the general trend of sales is upward. Factories are busy, however, and the increasing shortage of labor in industry is stimulating interest in the economic utilization of electrically operated drills, industrial irons and many other appliances designed to expedite shopwork. Current stocks are sufficiently lowered now to require more attention to purchasing, and there are still intermittent embargoes on the railroad lines between factory and distribution points. As in other lines, raw material and labor costs are stiffening, and price trends are correspondingly firm.

Prime-Mover Prices Hardening with Rises in Labor and Material

INCREASING demands for central-station service throughout the country continue to cause orders for steam turbo-generator sets to accumulate at the manufacturing plants. Broadly speaking, the 1923 output has been sold out for many weeks if not for several months, and it is unsafe to figure on less than a year in estimating deliveries of large units. In the field of large plant development the 30,000-kw. unit continues popular as the normal upper limit of routine heavy practice. Probably upward of a million kilowatts of such units are now on order in this country. Turbine development along the line of increasing reliability of operation continues to absorb the efforts of designing engineers, and the approaching commercial application of the mercury boiler and turbine has aroused wide interest in commercial as well as in engineering circles. Higher boiler pressures are readily coming into service, superheat is being pushed upward, and something like a race in size development is under way between steam and hydraulic turbo units. The whole prime-mover market is alive with new developments; proposition work is fraught with unprecedented interest, and existing long deliveries have little effect upon competitive activities. Raw materials, long anticipated as to requirements, are in good stock at the factories, but the upward trend in costs of material, labor and overhead tends to harden prices at this time.

Signal Apparatus Strong with Orders from New Schools

ELECTRICAL signaling equipment is in excellent demand at present, school construction in many localities requiring liberal purchases of this line of material. Factory stocks are reported in good shape, and the making up of systems for interior telephone, annunciator and call-signal work is readily effected from existing parts in current storage. Many jobbers appear to leave the sale of these systems to the manufacturers, although some parts are carried for replacement service and a small installation work. Prices are firm and so far little complaint has been heard regarding the ability of manufacturers to obtain raw material in plants where the purchasing department is sensitive to pending delivery conditions.

English Electrical Exports Fell £56,296 in February

THE following are official values of electrical machinery, apparatus and material exported from England (a) during February, 1923, and (b) from Jan. 1 to Feb. 28, with increase or decrease compared with the corresponding periods of 1922. The total of electrical machinery, material and apparatus, other than insulated wire, was £936,482 for February, which was a decrease of £56,296 from those exports during the month of February, 1922.

Electrical machinery, (a) £284,290 (decrease £99,725), (b) £719,192 (decrease £232,087); including railway and tramway motors, (a) £28,170 (increase £12,992), (b) £44,991 (increase £13,-935); other generators and motors, (a) £131,968 (decrease £45,272), (b) £386,-027 (decrease £135,712), and other electrical machinery, (a) £124,152 (decrease £67,445), (b) £288,174 (decrease £110,310); telegraph and telephone cables, submarine, (a) £27,274 (decrease £33,811), (b) £102,395 (increase £37,917); other than submarine, (a) £67,000 (increase £32,766), (b) £121,-909 (increase £6,012); telegraph and telephone apparatus, (a) £170,932 (in-

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0322	$0.0312	$0.0229
Cold finished shafting, per lb.	0.0406	0.0402	0.0317
Brass rods, per lb.	0.1904	0.1804	0.15
Solder (half and half), per lb.	0.314	0.2617	0.20
Cotton waste, per lb.	0.1231	0.1181	0.109
Washers, cast iron (¼-in.), per 100 lb.	4.50	4.33	3.83
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	2.96	2.96	3.11
Machine oil, per gal.	0.349	0.349	0.40
Belting, leather, medium, off list	42%	49%	46⅓%
Machine bolts, up to 1-in. x 30-in., off list	48⅓%	51⅓%	64⅓%

crease £31,200), (b) £345,656 (decrease £15,147); other electrical wires and cables, rubber-insulated (a) £95,301 (increase £54,375), (b) £213,562 (increase £116,516); with other insulations, (a) £90,433 (decrease £24,550), (b) £176,788 (decrease £62,161); carbons, (a) £3,489 (increase £1,126), (b) £10,159 (increase £1,053); glow lamps, (a) £26,206 (decrease £3,377), (b) £55,238 (decrease £3,355); arc lamps and searchlights, (a) £300 (increase £159), (b) £746 (decrease £346); parts of arc lamps and searchlights (other than carbons), (a) nil (decrease £244), (b) £84 (decrease £697); batteries, (a) £47,168 (increase £23,169), (b) £94,523 (increase £36,130); electrical instruments (commercial and scientific), electricity meters, (a) £31,359 (decrease £4,369), (b) £56,993 (decrease £15,201); switchboards, (a) £7,538 (decrease £16,851, (b) £23,046 (decrease £87,318); other electrical goods and apparatus, (a) £85,192 (decrease £15,164), (b) £212,281 (decrease £10,995).

The Metal Market

Demand Is Less Active — London Prices Fluctuate Widely—Customers Are Scrutinizing Quotations

The week in the metal market has been a quiet one with only small price changes. Prices in London have fluctuated widely, however, and the unrest in that country has without doubt had an adverse effect on business here. Consumption in most lines continues excellent. Copper continues at 17.37½ cents delivered. Producers are well sold up, and it is unlikely that they will force their copper on an unwilling market for some weeks, so that no important price recession is likely. It is a fact, however, that the demand for manufactured copper products has weakened since the price went above 17 cents. The customers of the wire and brass mills seem to be watching the price of raw copper more than they formerly did and to restrict their buying if they think the price has risen too fast.

Heavy exports are going to Germany; of the total of 2,793 tons exported last Wednesday, 1,837 went to Germany.

NEW YORK METAL MARKET PRICES

Copper	Mar. 28, 1923 Cents per Pound	April 4, 1923 Cents per Pound
Electrolytic	17.37½	17.37½
Lead, Am. S. & R. price	8.25	8.25
Antimony	8.75	8.75
Nickel, ingot	30.00	30.00
Zinc, spot	7.65	7.65
Tin, Straits	48.00	48.00
Aluminum, 98 to 99 per cent.	26.00	26.00

Copper and Brass Products

Copper, brass and bronze mills quote the following prices on brass and copper products:

Copper wire, 19.87½ cents, mill; brass wire, 22.50 to 24.00 cents; copper sheets, 25.50 cents; copper rods, 20.37½ cents; brass rods, 20 to 24.50 cents; sheet brass, 21.75 to 23.50 cents.

Electric Elevator Manufacture.—According to figures issued by the Department of Commerce there were 117 establishments making electric elevators in the United States during 1921. Value of their products was $29,414,000. In 1919 there were ninety-four establishments, whose output amounted to $29,607,000.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUYING in most sections of the United States continues in heavy volume with slight advances in prices of wire, conduit, wiring devices and some high-tension equipment following the rising quotations in the raw-material markets. Business in second-hand motors is gaining in the East owing to increased activities in the textile and metal-working fields. Warmer weather is bringing more outdoor construction, with the result that poles, wire and meters are moving rapidly. Spring lamp replacements are making up a fair amount of orders. Aluminum wire is said to be receiving added interest.

Boston Little recession can be seen in buying, which is still conservative and well adjusted to demands in sight. Prices have increased again on sockets and switch plates, and connectors for flexible armored conductor also are quoted higher. Deliveries are quoted at longer periods. Motor stocks are decreasing materially. Some types of radio tubes are unobtainable. Outdoor construction is opening up gradually. A compromise wage increase is expected in the building field. Banking conditions are in good shape and retail trade is excellent. Unemployment is causing little concern and railroad conditions are better.

New York Buying is in heavy volume with prices generally firm for the last ten days, although slight increases are noted for wiring devices. Business in new and second-hand motors is slightly stronger than a few weeks ago, with depletion of stocks here and there throughout the Eastern territory. High-tension-equipment business is picking up favorably with increased buying by utilities. Construction business has given the wire market another strengthening turn. Large orders of meters are reported with lamps selling in large lots for spring replacements.

Atlanta Business in jobbing circles continues fair with little change from last week. The higher prices for lumber have caused advances in poles and cross-arms, and while sales are good, deliveries are becoming slower. Heavy construction is taking large quantities of conduit, and although shipments have improved, it is impossible to accumulate satisfactory stocks.

Pittsburgh No price changes of any importance occurred during the week. Dealers report good sales of washing machines following large advertising campaigns supported by manufacturers. Other appliance business is rather slow. Radio demand is holding up fairly well.

Cleveland Great increase in orders is reported. Retail sales are increasing rapidly in seasonal articles and business from the utilities is favorable. Added residences have brought about a heavier demand for meters. Fixtures likewise are moving well. Aluminum wire is attracting a great deal of attention because of higher quotations in the copper market. Conduit deliveries are more prompt. The general price trend is firm with the exception of radio, where some cutting is evident. Lamps are stronger. Collections are reported at sixty days.

Chicago Brisk trade is reported by dealers in this territory. Considerable quantities of conduit are being placed despite its shifting prices. Demand for motors remains active. High-tension equipment and pole-line hardware buying is stronger. Pole stocks are normal. Advances are expected in wire.

St. Paul-Minneapolis Colder weather has halted spring campaigns by jobbers and contractors. Falling off in demand for poles and other construction material is noted.

Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Washers and Cleaners; Irons and Storage Batteries

	Wire	Armored Cable	Conduit	Transformers	Poles	Pole Line Hardware	Porcelain	High-Tension Equipment	Fuses	Meters	Switches	Wiring Devices	Lamps	Commercial Fixtures	Motors	Radio	Farm-Lighting Plants	Signal Apparatus	Electric Tools
Boston																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Slow	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Slow	Act.	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Low	Nml	Nml	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Low	Nml.	Nml	Low
Price trend	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Firm	Dec.	Firm	Firm	Firm
New York																			
Demand	Act.	Act.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Act	Sdy.	Act.	Act.	Slow	Act.	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Low	Nml	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Low	Nml.	Nml	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Inc.	Firm	Inc.	Firm	Dec.	Firm	Firm	Firm
Baltimore																			
Demand	Act.	Slow	Act.	Sdy.	Slow	Slow	Sdy.	Slow	Act.	Slow	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Slow	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Atlanta																			
Demand	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Slow	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Sdy.	Sdy.	Slow	Sdy.
Supply	Low	Nml.	Low	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Pittsburgh																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
Cleveland																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Chicago																			
Demand	Act.	Sdy.	Act.	Act.	Act.	Act	Sdy.	Act.	Sdy.	Act.	Act	Act.	Act.	Act.	Act.	Act.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
St. Paul-Minneap.																			
Demand	Act.	Slow	Sdy.	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Slow	Sdy.	Slow	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
St. Louis																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Slow	Act
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
New Orleans																			
Demand	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Sdy.	Slow	Sdy.	Slow
Supply	Low	Nml.	Low	Nml.	Low	Low	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Denver																			
Demand	Act.	Sdy.	Act.	Slow	Sdy.	Sdy.	Sdy.	Slow	Act.	Slow	Sdy.	Act.	Act.	Act.	Slow	Act.	Slow	Sdy.	Slow
Supply	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Salt Lake City																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Slow	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Act.	Sdy.	Sdy.	Sdy.
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	High	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm
Portland-Seattle																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Slow	Slow	Act.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	High	Low	Low
Price trend	Inc.	Inc.	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Inc	Firm	Firm	Firm	Firm	Firm	Firm	Firm
San Francisco																			
Demand	Act.	Act.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Inc.	Firm	Dec.	Firm	Firm	Firm	Firm	Firm

High-tension insulators have advanced 10 per cent, with stocks depleted and factories two months behind with orders. The conduit situation is slightly relieved. Radio orders from rural districts show slight improvement.

St. Louis Appliance sales for March showed a very appreciable increase over the same month of 1922. Motor and transformer manufacturers are operating to capacity and are considerably behind with their orders. Farm-lighting plant sales in this district during last month were greater than for any month since 1917. Demand for radio equipment continues active. Strong demand for wire, wiring devices and fixtures is reported as the result of a large house-wiring campaign now being carried on by a public utility. Calls for second-hand motors are increasing.

San Francisco A fine fan year is predicted. Perhaps it will be even better than 1922 because of improved business conditions. Drastic steamer rate increases are expected. The six weeks' dry spell has been broken by a well-distributed rainfall. Contractor and dealer business is increasing. San Francisco building permits for March totaled $3,229,572.

Portland-Seattle Business is reported good, and building in this district continues to exceed last year's records. Prices generally are stronger. Conduit stocks are improving and incoming shipments are increasing. Deliveries in lead-covered cable are poor, shipments on paper-insulated being at thirty weeks and cambric at twenty weeks. Lamp demand is following seasonal requirements.

Denver Volume of sales for most lines is larger. Increased wage scales effective last week apparently have not affected the present heavy building program, and there is a marked absence of labor difficulties. Railroads report another increase in tonnage and car loadings, and incoming shipments are more prompt. Washing machine, range and vacuum-cleaner campaigns are being carried out in this territory with satisfactory results.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Vye-Smith Company, Inc., Opens New Boston Jobbing House

Murvyn W. Vye and Ray H. Smith have organized a new electrical supply jobbing house under the name of Vye-Smith Company, Inc., and will open for business at 199 Purchase Street, Boston, April 2. Mr. Vye is widely known in New England electrical circles, having recently been vice-president of the McKenney & Waterbury Company, Inc., of Boston, and for some years previous sales manager of the Wetmore-Savage Company, Boston. Mr. Smith was formerly on the sales staff of the latter organization.

Betts & Betts Open Branch Office in Philadelphia

The Betts & Betts Corporation, 645 West Forty-third Street, New York City, has recently opened a branch office in Philadelphia in charge of Vernon H. Walker as district manager at 1536 Cherry Street, where space has been provided for a complete line of stock. Frank Wolk, who has been actively engaged in the radio market in New York City, is now connected with Betts & Betts in charge of the metropolitan district sales staff.

Organizes Transmission and Street Lighting Department

The Capital Electric Company, Salt Lake City, has inaugurated a policy whereby its technical sales problems will be handled by a competent engineer. The company has organized a transmission and street-lighting department which is in a position to go into the engineering features of customers' problems. This department has been placed in charge of K. V. Laird. Mr. Laird is an experienced electrical engineer and a graduate of the University of California. He was formerly employed by the Anaconda Copper Mining Company in Montana and was also associated with the Gellert Engineering Company in Philadelphia.

Standard Turbine Makes Sales Appointments

The Standard Turbine Corporation, Wellsville, N. Y., announces the following appointments of representatives in connection with the sale of their steam turbines: Fred H. Dorner, 548 Milwaukee Street, Milwaukee; Craun-Liebing Company, 30 Euclid Arcade Annex, Cleveland; L. S. Vallely and Company, Whitney-Central Building, New Orleans; Leonard G. Payne, 806 Otis Building, Philadelphia; Castle & Wilson, 1601 Arrot Building, Pittsburgh.

The Standard Turbine Corporation, is manufacturing steam turbines in capacities up to 500 hp.

Am-plus Storage Battery Makes Rapid Recovery After Fire

The Am-plus Storage Battery Company, Chicago, in less than two months after a fire which on Jan. 24 nearly destroyed its plant at 741 Van Buren Street, has established an entirely new plant at 429 West Superior Street, where the manufacture of its products has been resumed under improved conditions. The new plant, besides having double the floor space of the old one, is newly equipped with entirely new machinery and is so laid out as to greatly facilitate manufacture, assembly and shipping. Provisions have been made for expansion on a large scale.

Philadelphia Firms to Exhibit at Civic Industrial Exposition

The Troupe Electric Company, Ambrose Diehl Electric Company, F. J. Saylor Company, Voight Company, Emery & Son, Abso Clean Sales Corporation, the Better Home and the Vital Sales Company, all of Philadelphia, have arranged for displays in the Philadelphia Palace of Progress, a civic-industrial exposition to be held in the Commercial Museum May 14-26.

The exposition will celebrate the two hundred and fortieth anniversary of the founding of Philadelphia and will represent the civic and industrial advancement of the city. All of the firms here mentioned will exhibit electrical appliances.

Electric Machinery Changes

The Electric Machinery Manufacturing Company, Minneapolis, manufacturer of synchronous motors and alternators, announces that F. F. Espenschied has been appointed in charge of its Pittsburgh office in the Union Arcade Building. The company also announces the establishment of its Cincinnati office in charge of C. G. Tarkington in the Mercantile Library Building.

Radio Corporation of America Report Shows Rapid Growth

The stupendous strides made last year in the development of its system of world-wide wireless and outlines of a comprehensive program of expansion in all parts of the world are reviewed in the annual report for 1922 of the Radio Corporation of America, issued to stockholders last week.

The extent to which business expanded in 1922 is shown by the fact that gross sales amounted to $11,286,489, compared with only $1,468,919 for 1921, and gross income totaled $14,830,856, against $4,160,844 for the year preceding. After all deductions, including reserves for amortization of patents, federal taxes and organization expenses were written off, there was a surplus of $2,974,579, an increase of $2,547,780.

Current assets of the company at the end of the year were $8,686,907, contrasted with current liabilities of $2,688,941. Of the assets $946,888 was cash, $2,445,925 accounts and notes receivable and $5,041,213 inventories. Current assets exceed the current liabilities by $5,997,966.

General Electric 1922 Sales Were $200,194,294

The General Electric Company reports net sales of $200,194,294 for last year, against $221,007,992 in the previous year. Despite the drop of approximately $21,000,000 in the volume of business, the net profits were larger than those reported in the previous year.

After payment of all expenses, charges and taxes and allowances for depreciation, net profits for the year were $26,231,019, which after dividends on the special $10 a share par value stock was equal to $14.86 a share earned on the $175,624,746 common stock of $100 a share par value outstanding at the end of 1922. The net profits for the previous year amounted to $12.57 a share on the $172,194,300 capital stock then issued.

	†1922	†1921
Net sales	$200,194,294	$221,007,992
Costs, expenses, etc.	*177,458,012	*199,331,309
Balance	$22,736,282	$21,676,683
Other income	8,058,684	6,478,984
Total income	$30,794,966	$28,155,667
Inventory reserve	.....	3,700,000
Interest	4,563,947	2,802,855
Surplus	$26,231,019	$21,652,812
Cash dividends	14,073,628	13,409,522
Stock dividends	8,717,265	6,746,114
Surplus	$3,440,126	$1,497,176
Appropriations	400,000	1,418,864
Previous surplus	70,126,921	70,048,611
Profit and loss surplus	$73,167,047	$70,126,921

*Includes depreciation, federal taxes, &c.
†Excludes accounts of International General Electric.

The consolidated balance sheet showed total assets of $355,445,492. Cash holdings were carried at $49,482,770 at the close of 1922 against $39,888,683 at the close of 1921; investments were valued at $63,892,232 against $75,326,382; government securities, $35,858,768 against $23,862,912; notes and accounts receivable $35,154,419 against $52,514,902, and inventories at $75,334,562 against $64,848,189. A total of $13,874,385 cash is carried in sinking-fund reserve. Accounts payable totaled $13,415,954 against $9,495,261.

Westinghouse Authorizes Sale of $14,962,530 Common Stock

Directors of the Westinghouse Electric & Manufacturing Company at a meeting last Wednesday authorized the sale of $14,962,530 additional common stock, which will be offered to stockholders at a subscription price of $53 a share, to the extent of one share of new stock for each five shares now held. The offer will be made to stockholders of record April 16. Payment for the stock must be made in full by May 31. In connection with the offering of new stock, Guy E. Tripp, chairman of the board of directors, sent the following letter to stockholders:

"Your company has a large amount of unfilled orders on hand, and is taking additional orders in large volume. In addition, the directors believe that there will be a still further enlargement in the demand for your company's products, due to the public attention which is now being directed toward hydro-electric developments, steam railroad electrification, industrial electric manufacturing processes, further development of activities in the radio field and a widening use of electricity for other purposes, all of which would stimulate still greater activity in your various manufacturing lines.

"After applying the proceeds of the sale of the new issue of common stock, the net quick assets of the company, as of March 31, 1923, will amount to $105,000,000.

"The net profits of your company available for dividends for the fiscal year ended March 31, 1923 (March estimated), will amount to about $12,000,000, while the dividend on the shares of your company, including the new issue of stock, at the rate now being paid, viz., 8 per cent per annum, will be $7,182,000."

Shakstad Moves to Larger Quarters

The Shakstad Electric Company, formerly at 213 West Ninth Street, Sioux Falls, S. D., has moved to larger and better quarters at 214 South Main Avenue, the same city, where it will be better prepared to give prompt attention to calls for new apparatus or immediate repairs to all makes of machines.

Ohio Brass Earnings $1,398,863 in 1922; $722,440 in 1921

Net earnings of the Ohio Brass Company, Mansfield, Ohio, manufacturer of insulators and other equipment, during the year 1922 were $1,398,863, as compared with those for the year 1921 of $722,440. The company during the past seven years has shown total net profits of $5,229,295, or a yearly average of $35.56 a share on the outstanding preferred stock and $6.49 on the outstanding common stock.

During the depression period the company's business showed only comparatively small decline and the period resulted in no losses to the company.

Balance sheet as of Dec. 31, 1922, shows the following items: Assets: Cash, $700,038; notes and accounts receivable, $1,570,986; United States and other securities, $496,412; inventories, $1,443,138; total current, $4,210,574; plant and equipment, $2,781,056, making total of $6,991,630.

Liabilities: Accounts payable, $448,622; reserve for taxes, $250,000; total current, $698,622; preferred stock, $2,100,000; common stock, no par, $1,922,580; surplus, $2,270,428.

The company recently completed and placed in production a new plant at Niagara Falls, Ont., to gain a better foothold in the Dominion and other British territory and is also contemplating a large addition to its Barberton subsidiary, the Ohio Insulator Company.

The New England Insulator Company, New Freedom, Pa., a subsidiary of the American Insulator Company, manufacturer of electrical insulating products and other electrical equipment, has leased property from the Danbury Industrial Corporation, Danbury, Conn., for the establishment of a new plant. It is thought that the New Freedom works may be removed later to the new location.

C. G. Everson & Company, manufacturer of electric light fixtures, 70 West Lake Street, Chicago, has leased the five-story-and-basement building at the northeast corner of Erie and Green Streets, where it will move its manufacturing equipment.

The Electric Storage Battery Company, Philadelphia, has adopted a night shift in a number of departments, in addition to a maximum day working force, officials of that company announce.

The Bell Lighting Company, 385 Broadway, New York City, has been incorporated with a capital stock of $100,000 and will manufacture electric and gas fixtures. It is taking over the property and assets of the Campbell Lighting Company, New York City, which has been in this business for some time. At present parts are being manufactured under contract, the company's activities consisting principally of assembing. It plans to do a part of its own manufacturing some time in the near future. The incorporators are C. A. Campbell, W. Weigand and A. C. Worgren.

The Home Specialties Manufacturing Company, recently organized, has entered into a manufacturing agreement with the S. S. Wenzell Machine Company, Philadelphia, to manufacture electrical household appliances. The new company is represented by Joseph C. Haines, 301 Market Street, Camden, N. J.

The Modern Sign Company, 5750 Woodward Avenue, Detroit, has been incorporated with capital stock of $75,000 to manufacture electric signs and displays, also to do general commercial work in electric sign rental. The company has a well-equipped plant, since it took over a company which has b... manufacturing for about two years. I... is estimated that this year's sales w... amount to about $200,000. C. L. Beswicke is general manager of the company.

The Cliff Electric Corporation, 59 Pearl Street, New York City, has been organized to manufacture and distribute electric phonograph motors. It is already on an operating basis, having a factory at Lebanon, N. H. S. A. Jacobs is president and I. M. Davis is secretary.

The Quality Electric Company, Los Angeles, manufacturer of electrical specialties, has plans in progress for the construction of a new one-story plant, 40 ft. x 175 ft., on San Pedro Street, and will call for bids at an early date.

The Hoosic Engineering Company, Hoosic Falls, N. Y., has been incorporated with capital stock of $20,000 to manufacture electrical products. Future plans of the company are undetermined, but no building will be undertaken at present. The chief incorporator of the company is E. Tiffiny.

The B. & H. Electric Company, Woburn, Mass., is taking bids until April 15 for the construction of a local plant, 120 ft. x 175 ft. and 60 ft. x 150 ft. estimated to cost approximately $100,000, with equipment.

The Rubber Insulated Metals Corporation has moved its general offices from 50 Church Street, New York City to 18 Oliver Street, Newark, N. J. The new location will give the company larger accommodations and afford every facility for handling a steadily increasing business.

The Superheater Company, 17 East Forty-second Street, New York City, announces the appointment of J. S. Cothran, Charlotte, N. C., as its representative in North and South Carolina.

The Cutler-Hammer Manufacturing Company.—The Pittsburgh office of the central district of the Cutler-Hammer Manufacturing Company, Milwaukee, will move on May 1 from the Farmers Bank Building to rooms 950 to 958 Century Building, on Seventh Street between Penn Avenue and Duquesne Way. A. G. Pierce is manager of this district.

The Bullock Manufacturing Company, 356 West Fortieth Street, New York City, manufacturer of lighting fixtures, has purchased two four-story buildings, 33 ft. x 102 ft., at 352-54 West Fortieth Street, for plant extensions.

The Electric Porcelain Manufacturing Company, Trenton, N. J., has filed plans for the construction of a new one-story building at its plant on New York Avenue, in order to increase production.

The Detroit Electrical Appliance Company, 9124 Linwood Avenue, Detroit, which was recently incorporated to manufacture electrical equipment, will do its work under contract. Its own activities will consist in assembling the parts in its shop. D. H. Ladd is president of the company.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in South Africa (No. 5,890) for a small modern plant for the manufacture of paper bags for grocers, to be driven by electricity, and to include a suitable printing press and type for printing the bags.

Purchase is desired in China (No. 5,893) of clay mills capable of pulverizing clay into fine flourlike paste for pottery purposes, capacity to be about 2 tons of clay per forty-eight hours, to be operated by electricity.

Purchase is desired in Mexico of tire-inflation equipment, including a 200-lb. pressure air tank, 1-hp. electric motor and a two-cylinder pump.

An agency is desired in Punjab, India (No. 5,912), for electrical goods, motor accessories, etc.

Purchase or agency is desired in Mexico (No. 5,917) of electric flatirons, 110 volts, 6 lb., costing about $3; electric stoves with two or three hot plates, carrying about 1,000 watts, and similiar electrical apparatus of a cheap grade.

An agency is desired in China (No. 5,918) for motors and accessories to generate electricity for lighting ten towns in that country, capacity ranging from 11 kw. to 110 kw. Price lists, descriptive catalogs, etc., are requested.

The following inquiries have been received by the Philadelphia Commercial Museum, which will furnish names and addresses of the inquirers to any one desiring them and mentioning the number given: Parties in Paramaribo, Dutch Guiana (No. 40,579), would like to get in touch with manufacturers of electrical apparatus, electrical engines, automobiles and supplies, batteries, etc. Parties in Trinidad, British West Indies (No. 40,590), would like to correspond with manufacturers of optical supplies and also violet-ray and other high-frequency machines. A party in Stockholm, Sweden (No. 40,588), would like to communicate with manufacturers of advertising articles and electric or non-electric moving signs and apparatus for show windows.

HYDRO-ELECTRIC POWER FOR SAO SEBASTIAO, BRAZIL.—Under a contract recently made with a local company, according to *Commerce Reports*, hydro-electric power will be supplied for lighting and power purposes in the city of São Sebastião, State of São Paulo. Electricity for the neighboring port of Caraguatatuba is included in the agreement.

CALL FOR BIDS FOR A MUNICIPAL LIGHT AND POWER CONCESSION.—A municipality in the State of Rio Grande, Brazil, *Commerce Reports* states, is calling for bids on the franchise for supplying electricity for lamps and motors. The concession will be granted for thirty years, the municipality having the right to purchase the concessionaire's property at the end of fifteen years. Bidders must agree to the use of specific water power and to the supplying of service at 120 volts. They must also state the power and light rates, both to the municipality and to individuals, for the first ten years.

New Apparatus and Publications

AUTOMATIC ELECTRIC LIGHT PLANT.—R. A. Lister & Company, Inc., 101 Park Avenue, New York City, has placed on the market an electric lighting plant that will start and shut itself off automatically.

INDICATOR LIGHT.—The H. T. S. Indicator Company, Chester, Pa., has brought out a device, known as "Lite-A-Meter," to protect the motor car from danger of overheating when the radiator indicator is not readily visible to the driver.

ETCHING OUTFIT.—The Union Electric Company, 933 Liberty Avenue, Pittsburgh, has placed on the market an outfit for etching ownership marks on lamps and other glass articles.

TOASTER AND GRILL.—The Chicago Flexible Shaft Company, 5560 Roosevelt Road, Chicago, has placed on the market the "Sunbeam" combined electric toaster and grill.

ELECTRIC CLOTHES DRIER.—An electric clothes drier has been developed by the Airo Electric Appliance Company, Columbia Bank Building, Pittsburgh, Pa.

POWER PLANT.—A light and power plant for portable and stationary work has been brought out by the Charles J. Bogue Electric Company, 513 West Twenty-ninth Street, New York City. The set can be operated in conjunction with storage battery if desired.

ELECTRIC RANGE.—A side-wall electric range has recently been placed on the market by the Standard Electric Stove Company, Toledo, Ohio.

WINDSHIELD CLEANER.—An electric windshield cleaner has been brought out by the Apco Manufacturing Company, Providence, R. I.

BELL STRIKER.—An electric bell striker for fire and danger signals has been placed on the market by the Electrical Automatic Appliance Company, 1749 Arapahoe Street, Denver, Col.

ELECTRIC STEAM VULCANIZER.—An electric steam vulcanizer which will repair two tubes at one time has been brought out by the Cross Vulcanizer Company, 1655 Blake Street, Denver, Col.

MULTI-SPEED MOTOR.—The Louis Allis Company, Milwaukee, has published a bulletin covering the "Watson" multi-speed motor. This motor is made in three types, two-speed, three-speed and four-speed, and is particularly adaptable to machine-shop requirements.

SOCKET.—The Tri Novelty Company, Wilson, Pa., is distributing a leaflet describing the "Neidig" drop socket.

New Incorporations

THE ALMOND LIGHT & POWER COMPANY, Albemarle, N. C., has been chartered with a capital stock of $100,000 by Jethro Almond, J. T. and David P. Dellinger.

THE BLOWING ROCK (N. C.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $125,000 by T. H. Coffee, D. A. Burkhart and W. L. Alexander.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MACHIAS, ME.—The Eastern Development Company, a subsidiary of the Bangor Railway & Electric Company, contemplates building an addition to its local power plant.

MEREDITH, N. H.—The Meredith Electric Light Company expects to extend its transmission lines to Tuftonboro and Winona and to purchase energy from the hydro-electric plant of the Utilities Power Company. C. M. Turner is secretary and treasurer.

PORTSMOUTH, N. H.—The Rockingham County Light & Power Company contemplates increasing the output of its plant. F. W. Randall is assistant general manager.

WINDSOR, VT.—The Windsor Electric Light Company expects to install an additional 50-hp., 2,200-volt, three-phase motor, directly connected to a centrifugal pump for the municipal water supply. Richard P. Osgood is superintendent.

HUNTINGTON, MASS.—The Huntington Electric Light Company contemplates establishing a twenty-four-hour service. E. A. Stanton is treasurer.

NORWICH, CONN.—The Eastern Connecticut Power Company has issued $3,000,000 in bonds, part of the proceeds to be used for extensions.

Middle Atlantic States

BROOKLYN, N. Y.—The Rubel Coal & Ice Corporation, 197 Glenmore Avenue, will install electric power equipment at its ice-manufacturing plant on Fulton Street, Hollis, to cost about $500,000. Edward Adelsohn, 1778 Pitkin Avenue, is architect.

COPENHAGEN, N. Y.—The Deer River Power Company contemplates building a new reservoir this year. V. C. Wood is manager.

FORT TOTTEN, N. Y.—Bids will be received by the Quartermaster Department, Torpedo Depot, until April 16, for 56,000 ft. submarine cable, nineteen-conductor, rubber-insulated, and fourteen cable reels.

LEICESTER, N. Y.—The Mount Morris Illuminating Company plans to extend its transmission line to Leicester and install a local light and power system.

MIDDLETOWN, N. Y.—The Orange County Public Service Corporation is building a new hydro-electric plant on Monagaup Falls of 5,000 hp., which will be placed in operation about May 1. The new 33,000-volt transmission line which will be connected with the line of the Honk Falls Power Company, Ellenville, will be completed about April 1. H. A. Farst is superintendent of electric stations.

MONROE, N. Y.—The erection of an interconnecting line with the Rockland Light & Power Company at Hillburn is under consideration by the Orange & Rockland Electric Company. R. W. Smith is president and manager.

WATERTOWN, N. Y.—The Power Corporation of New York contemplates building a hydro-electric plant on the Oswegatchie River, near South Edwards, to develop 10,000 hp. The cost is estimated at about $500,000. W. P. Creager, Northern New York Trust Company Building, is chief engineer.

WATERTOWN, N. Y.—Bids are being received by J. W. Ackerman, city manager, and P. B. Sutton, city engineer, for three 2,250-kw. generators, switchboard and transformer equipment for the new power plant at Delano Island. The cost is estimated at $75,000 to $100,000.

YONKERS, N. Y.—Electric power equipment will be installed by the Alexander Smith & Sons Carpet Company in connection with mill additions to cost about $1,000,000.

HIGHTSTOWN, N. J.—The Electric Light & Power Company of Hightstown plans to extend its rural line about 2 miles. Thomas J. Duncan is treasurer and superintendent.

NEWARK, N. J.—The Public Service Electric Company is planning to construct a power plant in the meadow section, to cost about $12,500,000. The station will be designed for an ultimate capacity of 160,000 kw. and will cost $25,000,000. Additional transmission lines for power service will be erected.

ALLENTOWN, PA.—Officials of the Pennsylvania Power & Light Company are organizing a number of subsidiary companies for the purpose of erecting transmission lines to various townships, with substations and distributing systems. Application for state charters will be made early in April. The companies will be known as the Dreher, Buck, Bear Creek, Lehigh, Salem, Denison, Paupack, Sterling and Palmyra Power & Light companies.

DOYLESTOWN, PA.—The Philadelphia Suburban Gas & Electric Company, Philadelphia, has acquired the property of the Bucks County Electric Company. A transmission line will be erected and the local power plant will be remodeled for a substation.

EAGLES MERE, PA.—The Eagles Mere Light Company will install two new waterwheels and governors within the next two months, to replace the present equipment, at a cost of about $11,000. R. D. Kehrer is general manager.

KANE, PA.—The American Water Works & Electric Company, New York, has issued $2,000,000 in capital stock, part of the proceeds to be used in connection with the acquisition of the Keystone Power Corporation, the Edison Electric Illuminating Company and the Cumberland Electric Railway Company and for proposed extensions and improvements.

MARCUS HOOK, PA.—The Viscose Company is planning to build a power house in connection with its proposed artificial silk mill, to be erected at Holmesburg Junction, to cost about $2,500,000.

MODENA, PA.—The Margargee Paper Company will build a power house in connection with a new mill at Edgeley, to cost about $500,000.

PHILADELPHIA, PA.—Electric power equipment will be installed in the proposed candy factory to be erected by the Brandle & Smith Company at Fifth and Bristol Streets, to cost about $360,000. The William Steele & Sons Company, Sixteenth and Arch Streets, is engineer.

YORK, PA.—The Pennsylvania Water & Power Company plans to erect a double-

circuit transmission line from Holtwood to supply energy to the Edison Light & Power Company. A substation will be erected at the city limits.

NEW CASTLE, DEL.—The Wilmington Fibre Specialty Company plans to install additional equipment in its power plant in connection with extension to its works, to cost about $250,000.

MIDDLEBOURNE, W. VA. — The West Virginia Light, Heat & Power Company plans to erect a transmission line from Sisterville to Middlebourne, and to install a local distributing system.

FORT EUSTIS, VA.—Bids will be received by the Quartermaster, United States Army, until April 10, for one electric watt-hour meter, 100 amp., and fifty electric watt-hour meters, 15 amp. (Circular 23-24).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until April 11, for ten mercury-arc rectifiers, 10 amp., for an eleven-cell storage battery (Proposal 14123-14 CP).

North Central States

GRAND MARAIS, MICH.—The installation of new boilers in the Grand Marais light and water plant is under consideration. A. Newberg is chief engineer.

WAYLAND, MICH.—The M. & W. Light & Power Company is erecting a transmission line to the village of Hopkins, a distance of 4 miles, to furnish electrical service. A distribution system is also being built in the latter place. Clarence L. Miller is secretary and manager.

AKRON, OHIO. — The Northern Ohio Traction & Light Company contemplates the erection of a 132,000-volt steel-tower transmission line from Cleveland for the purchase of 25,000 kw. of energy, the construction of a downtown transformer and distribution substation, and the erection of a 22,000-volt transmission line to Wadsworth and Rittman. M. W. Arthur is commercial manager.

FULTONHAM, OHIO. — The Pittsburgh (Pa.) Plate Glass Company will build a power house in connection with its proposed local cement plant for the Columbia Chemical Division, to cost about $1,500,000.

CALHOUN, KY. — The Public Service Company contemplates installing a 75-hp. oil-engine-driven generating unit. C. G. Gilmore is proprietor.

HARDINSBURG, KY.—The Hardinsburg Electric Light Company is planning to erect about 20 miles of transmission lines to five towns and will install a street-lamp regulator of about 5 kw. or 6 kw. capacity and also twenty-five street lamps. R. R. Compton is secretary and manager.

KUTTAWA, KY. — The Public Service Company, Inc., contemplates installing another generating unit of the same capacity as the present unit. William Eades is manager.

MIDDLESBORO, KY. — The Kentucky Utilities Company plans to install electric power equipment in connection with extensions to the former plant of the Middlesboro Ice & Storage Company, recently acquired.

WALTON, KY.—The Dixie Light & Power Company contemplates the erection of 3½ miles of 2,300-volt transmission line. Royal A. Pickup is manager.

INDIANAPOLIS, IND.—Bids will be received by the Board of Trustees, Indiana University, Bloomington, until April 12 for equipment for the proposed power plant at the James Whitcomb Riley Memorial Hospital, including electric generators and engines, water-tube boilers, mechanical stokers, electric elevators and auxiliary machinery. Charles R. Ammerman, Occidental Building, Indianapolis, is consulting engineer.

LAFAYETTE, IND.—The Board of Trustees, Purdue University, plans to build a power plant, to cost about $250,000.

MARTINSVILLE, IND. — The Central Indiana Power Company has purchased the Martinsville Gas & Electric Company and will merge it with the Spencer (Ind.) Light, Power, Heat & Water Company and the Morgan County Light & Power Company, Gosport, recently acquired. Extensions and improvements will be made in the systems.

TIPTON, IND. — The Tipton Electric Light Company, recently organized to operate the municipal electric plant, contemplates purchasing electricity from the Northern Indiana Power Company within the next three months to operate the local system. Robert E. Staats is manager.

AUGUSTA, ILL. — The Central Illinois Public Service Company has secured a ten-year street-lighting contract and will make extensions and improvements in the system. A commercial system will be installed at Wenona, where a fifty-year franchise has been secured.

BELVIDERE, ILL.—The Illinois Northern Utilities Company has been awarded a ten-year street-lighting contract. Extensions will be made in the system, including the installation of new incandescent lamps to replace present arc lamps.

EAST ST. LOUIS, ILL.—The Murphysboro (Ill.) Brick Company plans to build a power house in connection with its proposed local plant, to cost about $200,000.

ASHLAND, WIS. — The Lake Superior District Power Company plans extensions to its system including the installation of additional equipment, to cost about $700,000.

EAGLE RIVER, WIS. — The Electric Light and Water Commission is planning to extend the transmission line to Three Lakes, Clearwater Lake and nearby resorts to furnish electrical service in those towns.

MADISON, WIS.—The Wisconsin Power, Light & Heat Company has appropriated $925,000, for extensions to its system.

MARSHFIELD, WIS.—The installation of new street lamps on about 2 miles of newly paved streets is contemplated this year.

MILWAUKEE, WIS. — Work will soon start on the erection of various buildings, etc., in Castalia Gardens, Milwaukee. The cost of this amusement resort is estimated at about $1,000,000, a large portion of which will be used for the installation of electrical equipment. Electricity for light and power purposes will be supplied by the Milwaukee Electric Railway & Light Company.

PORT WING, WIS.—Work, it is understood, will begin on the power dam at Orienta Falls for the North Wisconsin Hydro-Electric Power Company as soon as the weather will permit. The plans provide for a development of 500 hp. and the erection of a transmission line to Port Wing and to Herbster, Cornucopia and Bayfield. The erection of a transmission line to Iron River and later to Washburn is also under consideration. T. N. Okerstrom, Port Wing, is president.

RHINELANDER, WIS.—Plans are being prepared by Mead & Seastone, engineers, Journal Building, Madison, for an addition to the power house of the Rhinelander Light & Power Company, to cost about $40,000.

TOMAHAWK, WIS. — The Tomahawk Kraft Paper Company will soon being work on the erection of a new high-tension line from here to the site of the proposed hydro-electric plant at Grandmother Falls, 5 miles from here, to furnish energy for construction work. After the completion of the plant it will be used to transmit power from the hydro-electric station to the paper and pulp mill in Tomahawk.

BLUE EARTH, MINN.—The construction of a new boiler room and the installation of a new boiler of about 350 hp. at the municipal electric light and water plant is under consideration. A new well is now under way and a pump will be purchased. Don Fitch is superintendent.

CANBY, MINN.—The Union Public Service Company is planning to install two new steam-driven units of 900 hp. capacity, to run condensing with boilers, condensers, spraying pond, etc.; also the erection of 25 miles of new line for 38,000 volts, and rebuilding a 13,000-volt line for 38,000 volts for a distance of 40 miles. A. H. Savage is secretary and treasurer.

LITCHFIELD, MINN.—Improvements are contemplated to the municipal electric light plant, including the installation of a 500-kw. generating unit, a 300-hp. water-tube boiler, stokers, etc. J. C. Bang is superintendent.

GRUNDY CENTER, IOWA.—The Grundy Center Electric Company is installing a 225-hp. Diesel oil engine directly connected to a 200-kva. Western Electric generator. J. B. Calderwood is owner and manager.

KNOXVILLE, IOWA. — The Marion County Electric Company contemplates the erection of 11 miles of 22,000-volt transmission line. Herbert Bellamy is secretary and manager.

ODEBOLT, IOWA.—The Odebolt Electric Service Company is planning to change its system to four-wire, three-phase, 2,300 volts to neutral and 4,000 volts between phase conductors, and to serve all farm lines at 4,000 volts, single-phase. H. E. Russell is manager.

SIBLEY, IOWA.—Improvements are contemplated to the municipal electric light plant, including the installation of a 250-hp. Stirling boiler, with hand-operated stoker, coal and ash-handling equipment. The cost of the work is estimated at about $17 000. Joseph J. Shoemaker is superintendent.

PARK RIVER, N. D. — The Light and Water Department is considering rebuilding part of the electric distributing system and the installation of a 50-hp. engine. J. L. McGurre is superintendent.

KILGORE, NEB. — Arrangements are being made for the construction of a transmission line for local service.

LYONS, NEB.—The Electric Light Department is planning extensions of the electric lines (2 miles) to outlying districts, with transformers. A. W. Cass is superintendent.

DODGE CITY, KAN.—The installation of a 350-hp. boiler and accessories is under consideration by the Electric Service Company. Otto Theis is vice-president and manager.

LURAY, KAN.—The municipal distribution lines are being built and a power circuit added. H. M. Olson is city clerk.

McCRACKEN, KAN.—Plans are under consideration for rebuilding part of the municipal electrical distribution system for heavier duty. L. L. Ryan is city manager.

McCUNE, KAN.—An election will soon be held to submit the proposal to grant the Kansas Gas & Electric Company, Wichita, a thirty-five-year franchise. Under the terms of the proposed franchise the company will take over the municipal electric distributing system. C. F. Liebig is superintendent of the municipal light and water plant.

Southern States

CONCORD, N. C.—The Hobarton Manufacturing Company contemplates the construction of a power house in connection with a local cotton mill, to cost about $400,000.

LAKEVIEW, N. C.—The Sandhill Power Company contemplates the construction of a hydro-electric plant, to supplement its present steam-operated station.

MARSHVILLE, N. C. — The Marshville Manufacturing Company will build a power plant in connection with its proposed local cotton mill, to cost about $115,000.

WHITAKERS, N. C.—Bids are being received by W. T. Hearne, superintendent of the municipal plant, for the erection of 5¾ miles of electric transmission line.

DUNCAN, S. C.—Bids are being received by Lockwood, Greene & Company, Piedmont Building, Charlotte, N. C., for four-story cotton mill, 135 ft. x 300 ft., a five-story storehouse, 75 ft. x 100 ft., bleachery, power house, etc., and 300 houses for employees, for the Pacific Mills.

BIRMINGHAM, ALA.—Complete rehabilitation of the municipal electric light and water plants at North Birmingham, to cost about $60,000, has been decided upon by the City Commission. Meters will be installed throughout both the lighting and water systems.

BROCKWAYVILLE, ALA.—The Brockwayville Light, Heat & Power Company is planning to extend its transmission lines about 5½ miles to serve electricity in the rural districts. B. J. Morrison is treasurer and manager.

CRUGER, MISS.—Bids will be received by the city of Cruger for construction of an electric lighting plant, including equipment. The Kramer Engineering Company, Magnolia, is engineer.

PLAQUEMINE, LA.—Bids will be received by the Mayor and Board of Selectmen of Plaquemine until April 17 for improvements to the light and water plant as follows: For three crude-oil engines, directly connected to alternators, motor-driven centrifugal fire pumps, motor-driven domestic service pumps, motor-driven air compressors, switchboard, etc. Swanson-McGraw, Inc., United Fruit Building, New Orleans, is engineer.

PONCA CITY, OKLA.—A special election has been called to vote on the proposal to issue $80,000 in bonds for extensions to the municipal power plant. A. M. Stalnaker is city engineer.

BROWNWOOD, TEX. — The Helious Gasoline Company, Dallas, contemplates the construction of a power plant at its proposed gasoline works, to cost about $250,000.

HOUSTON, TEX.—Work will begin at once on the first unit of the new electric generating plant on the Ship Channel for the Houston Lighting & Power Company, to cost about $4,000,000. The equipment for the initial installation will include two turbo-generators of each 20,000 kw. capacity. The plans provide for an ultimate capacity of 160,000 kw.

LONGVIEW, TEX.—The Lacy Oak Flooring Company plans to build a power house in connection with its proposed hardwood mill, to cost about $150,000.

Pacific and Mountain States

CHEHALIS, WASH.—The city of Chehalis has applied to the Supervisor of Hydraulics for permission to appropriate water from the Cowlitz River for power purposes. The cost of the proposed hydroelectric development is estimated at about $650,000.

LEAVENWORTH, WASH. — The construction of a power plant on Royal Mountain is under consideration by J. Naughton of the Royal Development Company.

TENINO, WASH. — The Puget Sound Light & Power Company will erect a transmission line from Olympia to connect with its Vancouver system.

PENDLETON, ORE.—Surveys are being made by the Pacific Power & Light Company for its proposed 66,000-volt transmission line from Pasco to Pendleton, via Umatilla. The cost is estimated at $300,000.

ROSEBURG, ORE.—Plans are under consideration by the Douglas County Light & Water Company to double the capacity of its electric plant at Winchester. The cost is estimated at about $200,000.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company is planning extensions to its electric plant, including the installation of a 17,500 kw. turbo-generator and auxiliary equipment; 12,000 electric meters will be installed on consumers' premises, and transmission lines will be extended.

SAN JOSE, CAL.—The Guadalupe Lime & Cement Company, San Francisco, plans to install a power plant at its proposed local cement mill, the cost of which is estimated at $275,000.

SAN RAFAEL, CAL.—Steps are being taken for the installation of an ornamental lighting system on sixteen blocks in the business section.

SANTA ANA, CAL.—Bids will soon be asked for the installation of an ornamental lighting system on Fourth and Fifth Streets, consisting of eighty metal standards, to cost about $30,000. W. G. Knox is city engineer.

TAFT, CAL.—Bids will soon be called for the installation of an ornamental lighting system on Fourth and Fifth Streets, comprising fifty-four standards. Edward M. Lynch is city engineer.

VENICE, CAL.—The Southern California Edison Company will make extensions to its system in this district, to cost $400,000, including new transmission lines.

VISALIA, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in the business section.

YREKA, CAL. — The California-Oregon Power Company will rebuild its transmission line from Fall Creek to Yreka. The voltage of the line from Fall Creek to Montague will be increased from 34,000 to 60,000 volts.

CALHAN, COL.—At an election to be held May 3 the proposal to install a municipal lighting system will be submitted to the voters.

DENVER, COL.—A proposal to install a new fire-alarm system, to cost about $200,000 will be submitted to the voters at the coming election.

CARLSBAD, N. M.—The Public Utilities Company will install a new 300-hp. vertical water turbine and a 210-kva., three-phase, 2,300-volt alternator this summer. A new 170-kva., directly connected alternator will be put on oil engine. A new telephone switchboard, new lines, etc., are contemplated for telephone system, and some improvements will be made to the water system. E. A. Roberts is manager.

Canada

ROSSLAND, B. C.—The West Kootenay Power & Light Company, Ltd., has petitioned the Provincial Department of Lands for permission to double the output of its main power plant at Bonnington Falls on the Kootenay River.

TORONTO, ONT. — The Bell Telephone Company contemplates improvements in the Hudson exchange district, including wire, cable and underground conduit work, to cost about $255,000.

RIMOUSKI, QUE.—Plans are being prepared by the Lower St. Lawrence Power for a water-power development on the Metic River. The generating station will be built at Princeville and a transmission line erected from Matane to Princeville, a distance of 80 miles. Bids, it is understood, will be asked in May.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 13, 1923)

1,448,381. CONTROL SYSTEM; E. M. Bouton, East Pittsburgh. App. filed May 12, 1919. Control apparatus for reversing motors.

1,448,382. MOTOR-CONTROL SYSTEM; E. M. Bouton, East Pittsburgh, Pa. App. filed Dec. 14, 1920. Thermal control system for starting motors.

1,448,388. ELECTRIC FURNACE RESISTOR; O. A. Colby, Irwin, Pa. App. filed June 3, 1921. Combined granular and solid resistor.

1,448,389. ELECTRIC PERCOLATOR; O. A. Colby, Irwin, Pa. App. filed April 18, 1922. Two-shell receptacle.

1,448,398. RESISTOR FOR LIGHTNING ARRESTERS; L. R. Golladay, Wilkinsburg, Pa. App. filed May 10, 1922. Several discharge gaps with liquid resistance connected between gaps and ground.

1,448,402. MEASURING SYSTEM; S. Q. Hayes, Pittsburgh, Pa. App. filed June 5, 1916. Totalizing wattmeter.

1,448,403. COIL SUPPORT; S. C. Hoey, Wilkinsburg, Pa. App. filed Sept. 19, 1919. Supporting structures for field-magnet coils.

1,448,405. ELECTRICAL SYSTEM; G. W. Huey, Wilkinsburg, Pa. App. filed March 9, 1917. Phase-reversal protection for three-phase motors.

1,448,408. DUPLEX CARRIER-WAVE SYSTEM; J. S. Jammer, New York, N. Y. App. filed Jan. 21, 1920. Applied to carrier-current telephone systems.

1,448,409. FREQUENCY REGULATOR SYSTEM; C. H. Kidl, Pittsburgh, Pa. App. filed March 31, 1920. For governing the speeds of prime movers.

1,448,410. REGENERATION OF SINGLE-PHASE MOTORS; J. M. Labberton, Wilkinsburg, Pa. App. filed Sept. 13, 1919. Regulation of alternating-current commutator motors during regenerative periods.

1,448,413. ELECTRODE; F. J. Metzger, New York, N. Y. App. filed July 29, 1920. For luminescent lamp bulbs.

1,448,419. FLASH GUARD FOR DYNAMO-ELECTRIC MACHINES; M. W. Smith, Wilkinsburg, Pa. App. filed May 14, 1920.

1,448,420. TELEPHONE-EXCHANGE SYSTEM; P. C. Smith, Worcester, Mass. App. filed Sept. 30, 1919. Automatic or mechanically controlled switching devices.

1,448,437. TROLLEY-WIRE HOLDER; M. L. Dunlap, Philipsburg, Pa. App. filed Oct. 14, 1922. U piece around wire clamps onto ear.

1,448,474. TROLLEY HARP; L. Vollmuth, Chicago, Ill. App. filed Nov. 25, 1921. Device to prevent pole from leaving wire.

1,448,484. GENERATOR AND BATTERY CONTROL; G. Fornaca, Turin, Italy. App. filed Jan. 12, 1920. Automatic battery-charging system.

1,448,510. APPARATUS FOR ELECTRICAL HEATING OF FLUIDS; P. A. E. Armstrong, Loudonville, N. Y. App. filed April 16, 1921. Non-rusting element immersed in fluid.

1,448,511. BRUSH FOR ELECTRICAL MACHINERY AND METHOD OF MAKING SAME; O. E. Becker, Oak Park, Ill. App. filed June 4, 1919. Gage brush.

1,448,523. TELEPHONE-EXCHANGE SYSTEM; R. D. Conway, Chatham, N. J. App. filed Oct. 23, 1918. Signaling means for telephone switchboards with co-operating circuits for extending incoming circuits.

1,448,540. APPARATUS FOR MEASURING GAS PRESSURES; W. G. Housekeeper, Philadelphia, Pa. App. filed July 14, 1917. For evacuated tubes or lamps.

1,448,542. PROCESS OF MANUFACTURING LOADING COILS; B. H. Jackson, New York, N. Y. App. filed March 20, 1920. Method of manufacturing cores for inductance coils for telephone lines.

1,448,550. THERMIONIC AMPLIFIER CIRCUITS; H. D. Arnold, Maplewood, N. J. App. filed Feb. 3, 1919. Vacuum discharge repeater for telephone lines.

1,448,553. TELEPHONE-PLUG SHELF; F. F. Lucas, East Orange, N. J. App. filed April 24, 1920. For telephone manual switchboards.

1,448,559. ELECTRICAL PROTECTIVE DEVICE; D. T. May, New York, N. Y. App. filed Dec. 6, 1920. Communication-wire lightning arrester utilizing carbon gap.

1,448,563. MOTOR CONTROL; N. L. Mortensen, Milwaukee, Wis. App. filed June 12, 1920. Provides for uniform lowering speed of cranes.

1,448,566. WIRE FABRIC MANUFACTURE; O. Muller, Jr., Brooklyn, N. Y. App. filed Sept. 20, 1919. Manufacture of wire-mesh grids for vacuum tubes.

1,448,572. TELEPHONE SYSTEM; L. Polinkowsky, Antwerp, Belgium. App. filed April 29, 1920. Machine-switching apparatus utilized for setting up connections.

1,448,575. WAVE METER AND SIMILAR ELECTRICAL DEVICE; G. H. Stevenson, Rye, N. Y. App. filed Dec. 21, 1920. Frequency calibration of meter not affected by opening or closing circuit.

1,448,576. TELEPHONE-EXCHANGE SYSTEM; W. B. Strickler, East Orange, N. J. App. filed March 19, 1921. Establishing connections between extension lines of private branch exchange.

1,448,578. RESISTANCE ELEMENT; A. R. Swoboda, Newark, N. J. App. filed March 10, 1922. Coreless winding of insulated wire formed into an elongated unit.

1,448,583. DIRECT-CURRENT TRANSFORMER; H. J. Van der Bijl, New York, N. Y. App. filed May 8, 1916. By means of thermionic tubes and induction coil.

1,448,586. PROCESS OF MANUFACTURING ALUMINOUS ABRASIVES; T. B. Allen, Hamilton, Ont., Canada. App. filed April 22, 1922. By smelting with powdered coke and a metal.

1,448,604. COLUMN STRAIN INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed Dec. 6, 1918. Guy-wire insulators.

1,448,621. PIPE-OPERATING DEVICE; G. A. Fletcher, Brazil, Ind. App. filed July 26, 1920. Service pipes laid in ground by drilling hole.

1,448,676. RECEIVER; E. Reisz, Zehlendorf-Mitte, Germany. App filed May 25, 1921. Adaptable to loud-speaking telephones.

1,448,681. ELECTRICAL RESISTANCE; E. R. Stoekle, Milwaukee, Wis. App. filed Sept. 11, 1922. Grid leak for the vacuum tubes.

1,448,700. LIQUID-COOLED ELECTRIC MACHINE; M. Seidner, Budapest, Hungary. App. filed March 18, 1919. Liquid-tight channels in both stator and rotor.

1,448,702. TRANSLATING CIRCUITS; J. R. Carson, Montclair, N. J. App. filed July 10, 1920. Modulator arrangement to vacuum-tube sending or receiving apparatus.

(Issued March 20, 1923)

1,448,749. ELECTRICAL SYSTEM FOR AUTOMOBILES; C. F. Kettering, Dayton, Ohio. App. filed April 6, 1918. "Delco" system with 110-volt generator.

1,448,750. TELEGRAPH PRINTER; E. E. Kleinschmidt, Brooklyn, N. Y. App. filed April 14, 1916. Direct method of selecting and operating type bars of the printer.

1,448,773. TRANSMISSION-LINE INSULATOR; F. W. Springer, Minneapolis, Minn. App. filed March 7, 1919. Protecting insulation from abnormal voltages by arcing gaps.

1,448,792. METHOD OF MAKING MASTER PHONOGRAPH RECORDS; W. H. Cole, Newark, N. J. App. filed Aug. 10, 1921. Metal deposited by precipitation from solution distributed upon the wax record.

1,448,815. SELF-WINDING CLOCK; F. J. Reilly, New York, N. Y. App. filed Feb. 27, 1920. Electrically operated primary movement.

1,448,816. SECONDARY CLOCK; F. J. Reilly, New York, N. Y. App. filed Feb. 27, 1920. Secondary clock wherein hands are gravity operated.

1,448,824. TELEGRAPH REPEATER; R. C. Blakeslee, Milwaukee, Wis. App. filed Dec. 20, 1920.

1,448,902. MEANS FOR REGULATING THE SPEED OF ELECTRIC MOTORS; W. Schäffer, Berlin, Germany. App. filed May 3, 1922. Motors for radio sending apparatus.

1,448,923. ELECTROLYTIC PROCESS; F. N. Flynn, East Orange, N. J. App. filed Oct. 29, 1919. Reduction of lead sulphate to lead.

1,448,949. ELECTRIC LAMP STAND; R. J. Travers, San Diego, Cal. App. filed May 13, 1921. Table lamp made from telephone stand.

1,449,004. JEWELER'S PLATING MACHINE; F. A. Howe and S. W. Howe, Spencer, Iowa. App. filed Sept. 11, 1922.

1,449,008. ELECTRODE FOR ELECTROLIZING FUSED MATERIALS; T. Kolkin, Vadheim, Sogn, Norway. App. filed June 27, 1921. Support for diaphragm between electrodes.

1,449,022. BRAIN TELEPHONE; W. B. Vanderlip and C. H. Viggars, Los Angeles, Calif. App. filed Dec. 21, 1921. Translation of sound vibrations to the brain without intervention of ear.

1,449,070. SIGNALING DEVICE FOR VEHICLES; W. E. Spangler, Arlington, Va. App. filed Jan. 25, 1918. Direction signal.

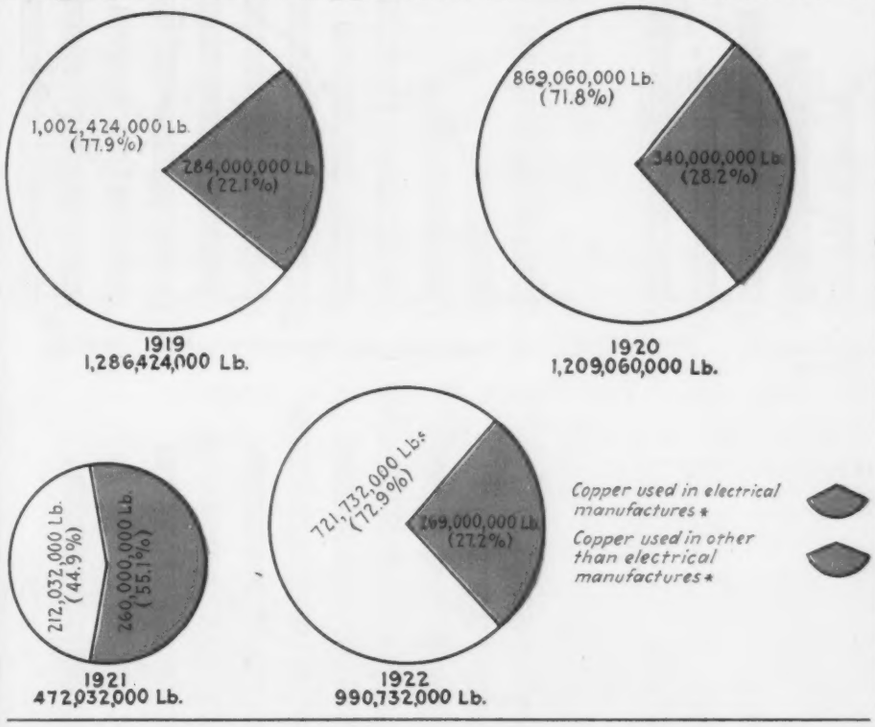
1,449,094. ELECTRIC IRON PROCESS; Albert E. Greene, Seattle, Wash. App. filed May 3, 1916. Deoxidizing process carried on in electric furnace.

1,449,148. DETECTOR FOR WIRELESS-TELEPHONE OUTFITS; W. F. Gehrig, Newark, N. J. App. filed March 9, 1922. Crystal detector holder and contact.

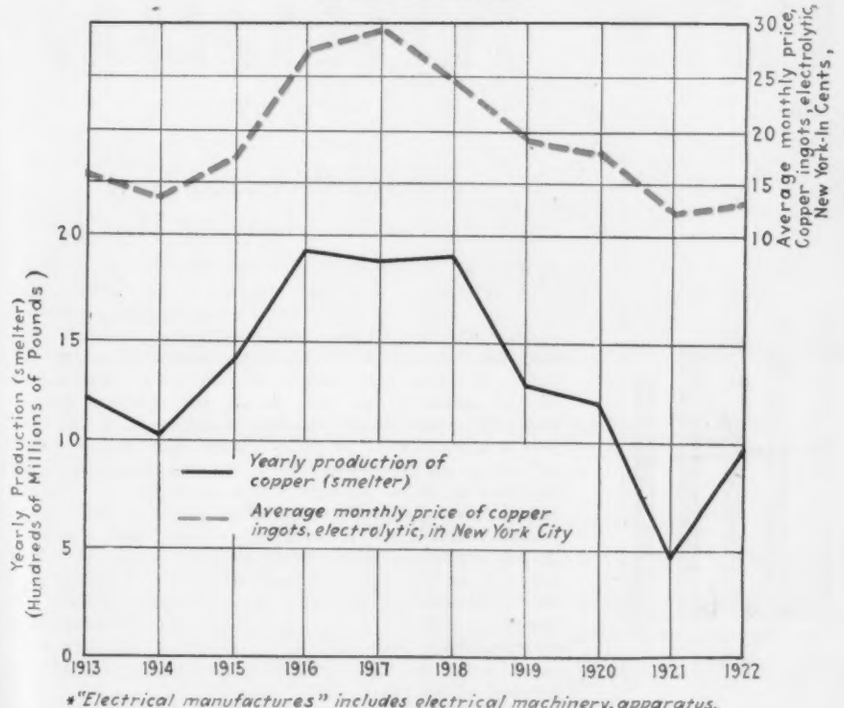
Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Large Quantities of Copper Used in Electrical Manufactures



Production and Prices of Copper Follow Same General Trend



*"Electrical manufactures" includes electrical machinery, apparatus, accessories, etc, but not conductors.

The Place of Copper in the Electrical Industry

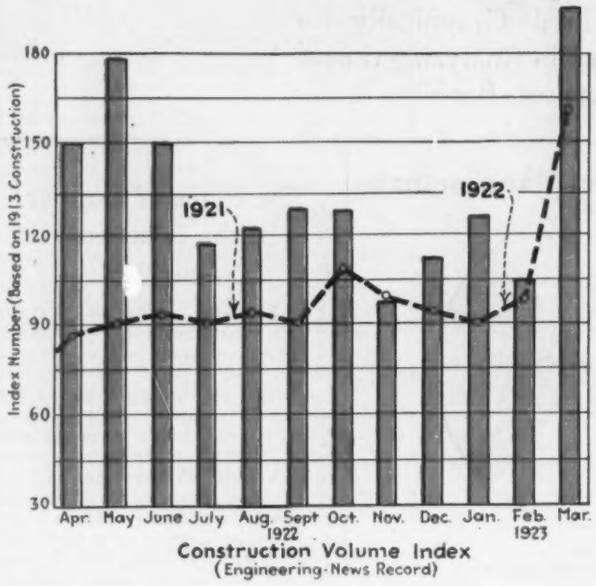
IN A LARGE way the story of copper during the past century and a quarter is the story of the development of the electrical industry. At the beginning of the nineteenth century Volta, Watt, Maxwell, Faraday, Siemens and many other scientists were engaged upon a series of researches on electrical phenomena that was only of academic importance. Their practical application was soon perceived by such men as Morse, Bell, Edison, Brush, and in the latter half of the nineteenth century the telegraph, telephone, generator, motor, the incandescent lamp, and the installation of transmission and distribution systems had opened up a vast field in the usefulness of copper. At present copper holds undisputed sway in the electrical field.

The accompanying diagrams which are based on data furnished by the American Bureau of Metal Statistics indicate the large percentage of copper production which ultimately finds its way into the manufacture of electrical machinery, apparatus, accessories, etc., but these data do not include conductors. If wire is included and also the brass used in electrical manufacturing it is probable that beween 60 and 70 per cent of the total copper produced is at present used by the electrical industry, and in a much higher percentage during the industrial depression of 1921.

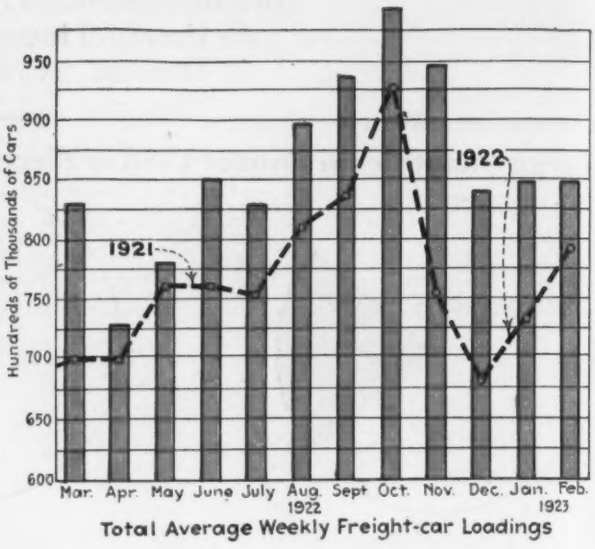
The price of copper has followed closely the general trend in copper production. During the war period the use of copper was tremendously increased due largely to its use in the manufacture of war materials, and the price rose with this increased market, the peak being reached in 1917. After this peak had been reached the average monthly price gradually returned to pre-war levels, reaching the low point in August, 1921. The present price is about 45 per cent above the low mark, and it is believed that still higher prices will come before the present boom is ended.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those using these statistics would credit the ELECTRICAL WORLD.

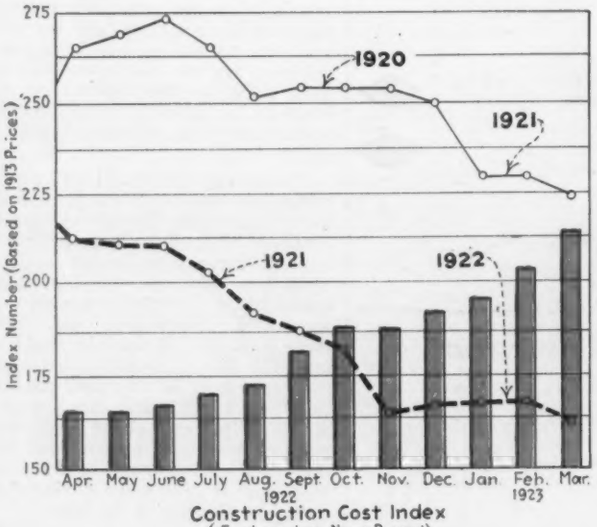
How the Primary Industries Are Trending



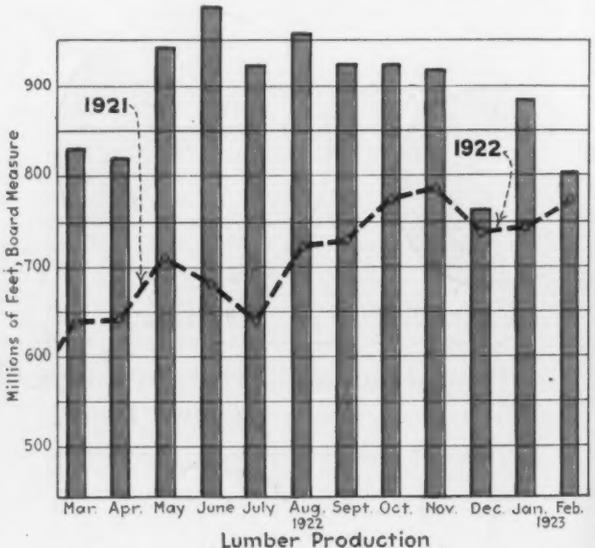
Construction Volume Index
(Engineering-News Record)



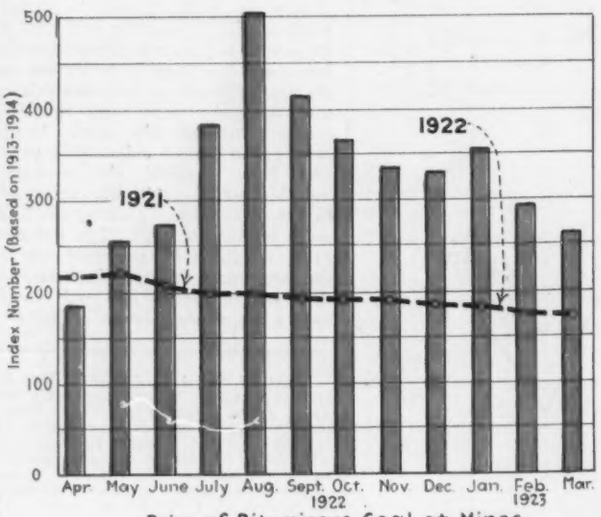
Total Average Weekly Freight-car Loadings



Construction Cost Index
(Engineering-News Record)



Lumber Production
(Yellow Pine and Douglas Fir)



Price of Bituminous Coal at Mines
(Coal Age)

Record Projected New Construction During March

MARCH witnessed the largest volume of projected new construction ever reported in the United States for any single month. The *Engineering News-Record* figures indicate that the new construction projected during March was almost 9 per cent over that of March last year. And this in the face of an increase in construction cost of almost 32 per cent during the 12-month period. It would appear, therefore, that the often expressed fear that a large portion of the projected construction would be held up on account of high prices is unfounded. New construction is so imperative this year that it is being undertaken in spite of costs which under ordinary conditions would serve to materially retard such activities. All of which has an optimistic bearing on the electrical industry, both in the future sale of electrical energy and the installation of electric apparatus and supplies. It begins to look as if the generating, manufacturing and merchandising activities of the electrical industry will exceed even the most optimistic prophecies made at the opening of the year.